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Meeting of March, 1921

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REPORT OF MARCH MEETING

also

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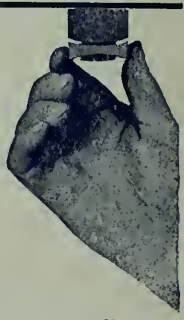

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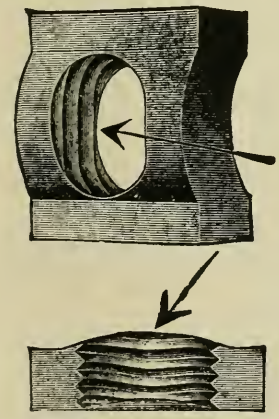

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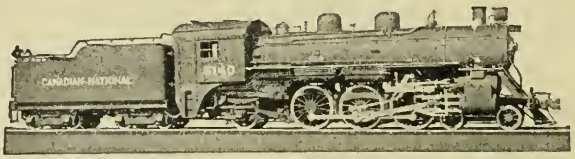

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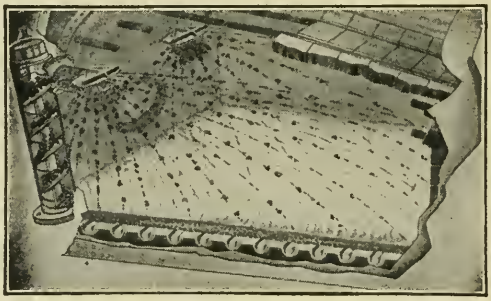

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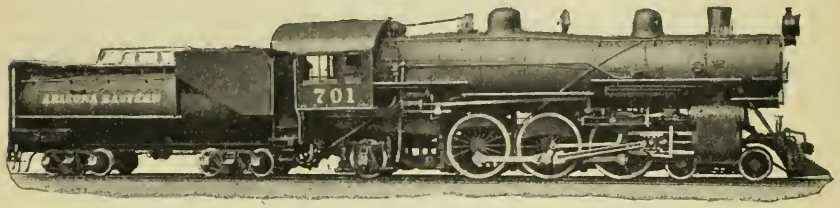

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W. A. BOOTH, Secretary, 131 Charron Street, Montreal.

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PROCEEDING OF THE CANADIAN RAILWAY CLUB.

Windsor Hotel, Montreal, March 8th, 1921.

Chairman, (Mr. W. H. Winterwood).

Gentlemen, the Secretary advises me that the minutes of our previous meeting have been printed and are being mailed to the members. We will therefore dispense with the reading of these minutes. May I call your attention to the cards which are on the chairs. I should like everyone here to sign one of these cards, whether he is a member or not. This so that we may have a complete record of the attendance. After signing, if you will kindly pass the cards down the row to the centre aisle the Secretary will later pass along and collect them. I am very anxious, and the Executive of this club is very anxious, to have a complete record of the attendance here this evening.

The next item on the programme is the reading of names of applicants for membership in the club. The Secretary will read some of these names and will make an announcement in connection with these applications which have been received since our last meeting.

Secretary:

Mr. Chairman and gentlemen, the following applications for membership have been received during the past month. It would take considerable time to read all of the names. I will, however, read a few giving you them in the order in which they have been received.

The complete list would take nearly half an hour to read, as there are 116 applications.

Chairman:

The list of applications is so large, gentlemen, that in view of the paper we have tonight, and the important discussion which will follow the reading of the paper, I will vouch for the majority of these applications, and would ask that someone make a motion that the total number of 116 applications be accepted and that these gentlemen be received as members of the club.

Mr. James Powell,

To save time, I will move that all these applications be accepted.

Mr. A. A. Goodchild,

I second that.

Chairman,

Moved by Mr. James Powell, seconded by Mr. Goodchild, that the following applications be duly accepted. All in favor please signify in the usual way.—Carried.

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Hammond, Arthur H., Draughtsman, Canadian Pacific Railway, Montreal.
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Thompson, G. S. The Superheater Company, Sherbrooke, P.Q.
Turnbull, T. G. Pass. Agent, C.P.O.S., Montreal.
Uren, W. J., Asst. Gen. Supt., C. P. O. S., Montreal.
Vincent, E. Asst. Foreman, C. P. R. Angus Shops, Montreal.
Wadsworth, J. P. Supervisor Car Dept. G. T. R. Montreal.
Weldon, R. B. Car Foreman, C. P. R. Montreal
Wensley, R. L., G. M. Basford Company, New York.
Whitelaw, G. A. Clerk, Taylor & Arnold Engineering Co., Montreal.
Wilger, W. P., Professor of C. E., Queens Univ. Kingston, Ontario.
Workman, E. E., 126 St Antoine Street, Montreal.
Wright, Roy V., Managing Editor, Railway Age, East Orange, N. J.

Members and Others Present.

Winterrowed, W. H.
Allan, A.
Allen, C. D.
Allyn, A. W.
Angus, D.
Arblaster, D. J.
Armstrong, H. T.
Arnold, D. R.
Ashby, F. D.
Ashe, A.
Ayers, J. R.
Baber, W. S.
Badour, G.
Baldwin, C. D.
Baldwin, G. E.
Balfour, G. A.
Bannon, J.
Bannerman, W. H.
Barclay, J.
Barefoot, O. R.
Barrett, C. W.
Barry, A. M.
Barton, A.
Basford, G. M.
Beatty, A. M.
Bentley, G.
Bolan, A.
Benger, F.
Bergen, F.
Berger, W. A.
Besse, R.
Birkett, L. H.
Blaiklock, H. M.
Blair, D. E.
Blumenthal, S.
Bourgouin, J.
Boyle, W. J.
Brady, C.
Branston, W.
Brazier, G. F.W.
Britton, J. H.
Brooks, L.
Brooks, P. A.
Brown, L.
Brownrigg, G. A.
Buckland, A. W.
Buckland, J. W.
Buckle, W. E.
Burke, W. M.
Burns, E. W.
Burns, J.
Burns, W. J.
Butler, A.
Butler, H. C.
Cameron, H. D.
Cameron, J. A.
Camp, W. J.
Campbell, A. J.
Canfield, A. J.
Carmichael, C.
Carter, J. W.
Cate, C.
Caton, S. W.
Clarke, J. E.
Clibbon, A. T.
Coffin, J. S.
Coleman, Jas.
Coleman, J. W.
Coleman, M. T.

Comley, W. J.
Conover, J. H.
Cook, J.
Conwell, W.
Crockett, W. B.
Crowhurst, W. H.
Curtis, T. H.
David, F.
Davis, A.
Daniel, W.
Daniels, H. E.
De Angelis, G.
Delaney, O. J.
Desrochers, G.
Desormeaux, T.
Diamond, P. R.
Dick, T.
Dickenson, T. E.
Donald, T. F.
Dunk, W.
Dunn, G. W.
Ellement, J. W.
Eley, E.
Elggren, E.
Emery, T. W.
Emery, J. W.
Ewan, W. E.
Falis, L. A.
Fallis, W. S.
Ferguson, T.
Ferguson, T. M.
Ferguson, T. P.
Fielding, W. G
Finkfeiner, E. J.
Firth, O. M.
Foley, E. L.
Forrest, W.
Forrester, C. J.
Fouse, F.
Fradd, F. J.
Fraser, D. W.
Fraser, J.
Fulton, J. L.
Gairnes, A. H.
Gallagher, F. S.
Garden, J. C.
Gardener, K.
Geldart, C.
Gillmor, W. D.
Gillespie, W. K.
Girard, J.
Groves, S. R.
Giroux, G.
Goldstraw, W.
Goodchild, A. A.
Goodenough, A. J.
Gordon, S.
Gray, C. N.
Gregory, W. A.
Greenough, W. C.
Green, G. B.
Grieve, J.
Griggs, H. O.
Hall, Grant.
Hall, J. G.
Halliwell, J.
Halton, W.
Hamer, T. M.
Hamm, W. C.
Hanmond, A. H.
Hampshire, A.
Hanson, L. J.
Harrigan, H. C.
Harrison, J.
Harvey, R. H.
Harrison, W.
Hatrich, J.
Harvey, O. F.
Hawes, W. L.
Hayden, J. E.
Hebert, C.
Hendry, J.
Hickey, J. V.
Hickman, F. C.
Hickok, W. H.
Holland, F. E.
Holland, N.
Holland, R. F.
Holmes, J. N.
Hope, P.
Horwood, W. W.
Harvey, R. H.
Hudson, D.
Hudson, T. C.
Hughes, J. W.
Hughes, W. L.
Hungerford, S. J.
Hunter, P. S.
Hunter, W C.
Inglis, W. H.
Ivory, W. M.
Jeffries, E.
Johnson, J. Will.
Johnston, R. H.
Jones, R.
Justus, I. J.
Keel, F. A.
Kell, G. A.
Kelly, E. J.
Kelson, H. L.
Keniston, C. R.
Kinnear, D. M.
Krauser, W. G.
Kurfes, L. S.
Lachapelle, J. D.
Lanno, F. G.
La Montagne, C. E.
Lathrop, C. B.
Landry, G.
Lawrence, E. A.
Lacavalier, L.
Leet, F. F.
Letendre, C.
Linagh, R K.
Lloyd, E. E.
Lloyd, G. H.
Lloyd, J. L.
Lowe, S.
Lowe, W. S.
Lowry, W. F.
Luscombe, H.
Macnab, E. S. M.

Manthorp, E.
Martin, C.
Marshall, T.
Marchand, L. N.
Maxson, H. W.
Mercur, R. J.
Merwin, C. T.
Messeroll, D. C.
Miller, W.
Minnns, A. E.
Misson, R. C.
Monks, T. H.
Morgan, W.
Moore, F. W.
Moore, J. H.
Morin, F.
Morrison, W. W.
Mullaly, M. J.
Murray, F. T.
Musgrove, G. W.
Maynard, T.
MacEnulty, J. F.
McCarthy, J.
McCurdy, L. R.
McCready, W. H.
McLaughlin, J.
McNown, W. L.
McVicar, R.
Naylor, H. R.
Needham, R. J.
Nelson, W. B.
Newman, W. A.
Newton, W. A.
Nobb, J. S.
Normandin, R.
Nye, H. F.
O'Donnell, M. J.
Organ, P. J.
Oviatt, H. C.
Palme, J. E.
Palmer, G. W.
Parks, G. E.
Parsons, H. J.
Payette, F.
Paxton, J. D.
Payne, H.
Peacock, R. W.
Peterson, W. A.
Peto, L. A.
Phillips, G.
Phillips, G. L.
Picard, J.
Pierpoint, F. H.
Plant, L. G.
Pomeroy, E. N.
Pope, A.
Powell, J.
Primeau, J. L.
Provost, A.
Prowse, A.
Prowse, W.
Pugh, G. W.
Reid, J. I.
Riddington, A.
Robb, J. D.
Robb, W. D.
Robins, H. S. W.
Robinson, W. A. H.
Robertson A. S., Jr.
Rodgers, H. L.
Rogers, R. C.
Rogers, W. B.
Rose, J. E.
Ross, J. D.
Ross, N. E.
Sage, R. V.
Sauve, G.
Schellens, E. L.
Seccombe, A. G.
Stenhouse, J. G.
Shaw, J. A.
Shortley, B. F.
Showe, J.
Simpson, H.
Smart, G. E.
Smart, W. T.
Smith, E. D.
Smith, R. A.
Sapp, W. E.
Speck, W. C.
Spence, W.
Starkey, J. B.
Summer, G. M.
Swinton, H. P.
Symmes, H. H.
Tate, W. F.
Tatum, J. J.
Taylor, S. G.
Tellier, T. J.
Temple, C. H.
Thomas, E.
Thomas, S.
Thornburn, C. D.
Thorp, A. E.
Thorp, H. W.
Tilt, E. B.
Tinkler, C.
Tinkler, J. E.
Tirbutt, A. M.
Viberg, E. R.
Vickers, V. G. R.
Vincent, E.
Wade, W.
Wadsworth, J. P.
Watson, J. H.
Watson, T.
Weaver, C. F.
Webb, W.C. H.
Wheatley, J.
Wheatley, J. H.
Wheatley, W. H.
Wheeler, H. C.
Whitcomb, F. O.
Whittaker, W. H.
Whitelaw, G. A.
Whitrod, W.
Wickson, F. R.
Wilding, G. G.
Wilding, Geo. G.
Wilkinson, W. H.
Will, Jas.
Winship, R. B.

Wright, Roy. V.	Yost, W. H.	Booth, W. A.
Wood, W. C.	Young, O. W.	
Wyer, F. H.	Zener, J. M.	and many others.

Chairman:

Gentlemen, we have with us tonight Mr. R. Stanley Weir, K.C., a gentleman known to practically all of you. He has a matter upon which he wishes to address you, and will explain this in his own words without further introduction.

Mr. R. Stanley Weir, K.C.:

Mr. President and gentlemen. It is my first duty to thank the President and officers of this club for the opportunity of speaking to you, and I wish in the first place, to congratulate you upon the evidence of strength and vitality of the club shown by the large number of members present here tonight. I must also thank the officers of the club for the privilege of being here tonight and for the opportunity of being able to do honor to one to whom honor is certainly due one of your own members. I intend in a very few words, to give you a little information about a matter of contemporary history. On the 1st September last one of your members was a passenger on one of the tramways which run along the gorge and shore of the Niagara River, between the Whirlpool Rapids and the Lower Bridge. As he was disembarking from the car, or about to do so, he observed a young woman step off on the side between the car and the bank of the river, the place being extremely narrow; and he saw that this young woman lost her footing and fall into the boiling torrent. Without hesitation he ran below for a distance, plunged into the river not very far from the Whirlpool Rapids and succeeded in bringing this young woman to shore safely. I give you this outline but you can more readily imagine the details for yourselves. To jump into the river ,at the risk of his own life, to save a human creature, is a splendid act of heroism on the part of any man. This young man jumped into the river at its swiftest point, and at the risk of his own life saved this young woman who had been caught by a projecting rock, bringing her to shore where the bank was very steep and where they were rescued by willing hands. That was a splendid act, and the facts having been brought to the attention of the Royal Humane Society, they took the matter up

and after due investigation came to the decision that this brave act ought to be rewarded, and after due deliberation they have decided to present their Bronze Medal, which is the highest gift they can bestow, to Mr. Gordon W. Dunn, a member of the Canadian Railway Club.—(Applause).

I can only say, gentlemen, that it gives me unqualified pleasure to present this Medal of the Royal Canadian Society to Mr. Dunn. Conduct such as his is not only splendid in itself, but also in its effects as has been proved from time to time by humanity when we read of how a man forgets himself to save another. The motto of "Safety First" does not apply in a case such as this, where a man risks his own life for the express purpose of saving someone else in danger and distress.

The young lady in this case hails from Philadelphia. I am not aware that the romantic sequel which usually follows when a young man risks his life to save a young woman, but I think Mr. Dunn's affections are either already engaged or possibly he is married in which event his affections should be permanently engaged, but whatever they are I have no doubt they are entirely creditable to him — (Laughter.)

I may say that the circumstances I have related have been abundantly confirmed by the young lady from the City of "Brotherly Love."

Let me add that yesterday I was waited upon by some friends of Mr. Dunn, officers and staff of the firm with which he is employed, who did not wish their names to be mentioned but wanted to show their appreciation of the brave deed of their colleague, and on their behalf they have asked me to present him with this cigarette holder, which I take great pleasure in doing. I will ask Mr. Dunn to step forward.

Mr. Dunn, I have much pleasure in presenting you with this Bronze Medal of the Royal Canadian Humane Association which you have so gallantly won by your conduct at Niagara Falls, on September 1st, last, and also this Cigarette case from your fellow officers and staff of the firm with which you are employed. I will ask the audience to give three cheers for Mr. Dunn.

(Three cheers were given and a "tiger." Considerable applause following after which Mr. Dunn replied.)

Mr. G. W. Dunn:

Mr. President and gentlemen, I did not think when I slid down the rocks of Niagara Gorge — in which act, incidently, I lost the seat of my breeches — that I would be called upon to stand before you tonight and be eulogized by Judge Weir. However, I would rather receive this present at his hands than the usual things he hands out to those who come before him. Mr. Weir intimated that there might be a romantic sequel, but I might tell you that I am already well married, and I know it is not the intention of Judge Weir to encourage bigamy.

As I am taking up the time of a gentleman more worthy than myself I will just say "thank you", and I hope you wont hold this against me.

Chairman:

Gentlemen, the paper of the evening is entitled "Repairs or Maintenance of Steel Freight Cars." I need not emphasize that the subject is important as this is well indicated by the attendance here to-night. The paper has been prepared by a gentleman who, to the best of my knowledge, has had more to do with the repairs to that class of equipment than any other man of whom I know. I have great pleasure in introducing Mr. Samuel Lynn, Master Car Builder of the Pittsburg & Lake Erie Railroad, who will read his paper.

Mr. S. Lynn:

Mr. President, members and guests, I hardly know what I should say this evening. Your President gave me an invitation some few months ago to come here and read a paper on the repairs to steel cars. I tried to get out of it but he would not let me, and I want to say right here that you have got a president who is a "live wire," and the membership and attendance here to-night shows it. I think your president has taken me at a disadvantage as in the literature put out he advertised me as an expert—a doctor or surgeon who operates on freight cars. (Laughter.)

Some years ago I did repair work on cars but that was before we had many steel cars. When we got that class of equipment I took a foreman's job, and my company have seen fit to retain me in a supervisory job ever since. I am glad to be with you this evening, and if I am able to suggest anything that is worthy of discussion I shall have been fully repaid. I might say that in getting out this paper I

had in mind the story of the ladies' dress—that is, I tried to make the paper short enough to be interesting but long enough to cover the subject. (Laughter.) I will read the paper and should like also to make a few remarks as I go along.

REPAIRS OR MAINTENANCE OF STEEL FREIGHT CARS

By referring to the various railway publications for the last four or five years, it was noted that the subject assigned the speaker, has been discussed in one form or another, either before the different Railway Clubs, or by papers written for publication, and from the number of articles found, it would appear that almost every angle of the subject had been covered, and in order to prepare a paper that would deviate from those with which you are possibly familiar, I have taken the liberty to wander somewhat from the direct subject and include a brief outline of some features, which, while not directly related to steel car repairs, nevertheless are essential to the proper maintenance of equipment. From what has previously been said and written, the subject of the evening may appear to be as rather wornout, or an "old chestnut," but from the speaker's viewpoint, it is not only timely but is also one of the most important. that concerns the railroads of both Canada and the United States.

The history of the steel freight car is modern history, since it has been known in general service for less than twenty-five years. Its development has been gradual, starting with self-clearing hoppers and drop bottom gondolas of 80,000 pounds capacity and extending at the present time to every type of railroad service.

Heavier motive power, with greatly increased train tonnage, has created a demand for cars of increased capacity. The limit of capacity apparently has not yet been reached, since one of the large car companies, has, within the year, constructed cars of 120 tons capacity.

While no accurate figures are available, it is estimated that approximately seventy percent of the two and one-half million freight cars in service in North America are either of all steel, steel underframe or steel center construction. As this number of cars represents an investment of over three billions of dollars, the importance of keeping them in good repair and in service is self-evident.

Repairs to steel cars are necessitated by the following causes; deterioration, caused by age and ordinary wear and tear, abuse, caused by rough handling and damage done in loading and unloading. The latter of these causes will not be discussed in this paper, since such damage varies greatly with the locality and with the service in which the cars are used, and is a matter for correction by individual roads and shippers.

Freight cars should be designed of sufficient strength to withstand the shocks incident to modern service, such as the starting and stopping of trains and necessary handling in yard switching. Some of the earlier cars were designed with a view of decreasing the dead weight and our experience has proven that the weight had been reduced too low to be consistent with satisfactory service. The tendency for a number of years past has been to increase somewhat the weight of the cars, not by using heavier steel plates for the sides of floors, but by strengthening the sills and also the sides, by the application of angles along the top of the sides of the cars and by the application of heavier draft gear.

Cars with wooden center sills and draft timbers have proven inadequate and this has led to the various reenforcement programs now in use on many railroads as a means of continuing their cars in service. The center sills, draft sills and draft gears should have sufficient strength to withstand the shocks to which they are subjected, or they will be broken, bent or buckled, with consequent extensive damage to the superstructure.

A casual inspection in almost any classification yard will reveal the fact that repairs to steel cars have been badly neglected during the past few years. Large numbers of cars may be seen with floor, hopper and side sheets badly corroded and in many cases, rusted and worn entirely through. A close inspection will usually develop the fact that center sills are buckled either in front of, or between, the body bolsters. This condition is due either to faulty construction, sills of insufficient area, abuse in service, or neglected maintenance. Conditions existing during the recent world war imposed many hardships upon the railroads generally, making it almost impossible for them to keep the maintenance of their freight equipment up to pre-war standards. Shortage of labor and materials, coupled with the pooling of equipment, had a tendency toward deferred maintenance, which resulted in merely patching up worn out cars and

keeping them in service long after they would have been shopped for rebuilding under a normal maintenance program. The large percentage of home cars on foreign roads resulted in neglect, since proper material for repairs of foreign cars was not generally carried in stock. This resulted in makeshift repairs, most roads doing only enough work on foreign equipment so that it would haul one more load, in the hope that it would carry that one load off the line and never return. The results of this practice are now most evident when cars are being returned to the home roads in large numbers and in almost universal bad order.

In the matter of painting, steel cars have also suffered from neglect. While it may be a debatable question as to whether or not it pays to keep the bodies of open top steel cars well painted, you will all agree that it is at least necessary to preserve the identity of the car. The speaker believes that the exterior of steel cars should be kept well painted, as by this process at least one side of the steel is protected against corrosion, and in addition to this, well painted equipment is a good advertisement for any road. It is obviously impractical to attempt painting the interior of open top steel cars, since the commodities usually carried in such cars consist of coal, coke, iron ore, limestone, furnace slag and mill products, which, in the process of loading and unloading so badly damage the paint, that it would serve no purpose as a protective coating. The interior of steel equipment is where corrosion is the most evident and is probably due to moisture laden with acids from the products of the mines and mills, or to electrolysis caused by impurities existing in the steel itself.

There is also a difference of opinion among mechanical officers as to the maintenance of steel cars. Some recommend patching up the holes and repairing the damage caused by wear and corrosion, as long as practicable and when deterioration becomes too extensive to warrant further patching, the car body is cut up and scrapped and new bodies built and placed on the old trucks, or if the trucks are of insufficient capacity, or poorly designed, the entire car is scrapped and replaced with a new unit of equipment. Others maintain that it is better to give the car current repairs by renewing the parts as fast as they become defective, thereby prolonging the life of the car indefinitely.

It is not the purpose of this paper to try to convert you to either of these systems, as both have their merits. So

many things must be taken into consideration in a discussion of this subject, that it is impossible to give them more than passing notice here . The reproduction cost of the body, the cost of providing necessary additions and betterments, the condition of the trucks, the capacity of the car, the class of service for which it is intended, and the expectation of future life in service, must also be taken into consideration. Another feature that cannot be overlooked, is the repair facilities of the home road and the number of cars awaiting rebuilding. It may develop that several series of cars fail at about the same time, and, with a large number of cars standing out awaiting extensive repairs, amounting practically to rebuilding, at a time when they are badly needed in service, it might be advisable to retire one or two series in favor of new equipment, which could be constructed by outside companies in much less time than would be required to repair the bad order cars on hand at the shops of the owning road.

Up to this point the steel car has been dealt with in general terms and I would like to here state a few things that in my opinion, are necessary to maintain steel car equipment properly and economically.

First: Shops should be provided at points where heavy repair steel car work is to be performed. They should be well lighted and ventilated, and in the colder sections of the country, should be properly heated. Overhead crane service is desirable, and by proper arrangement, eliminates the necessity for material tracks between the working tracks, thereby decreasing floor space. Small wall or jib cranes should be installed for the purpose of handling yoke riveters, etc. The money expended for shops will repay the investment many times over in a few years and it is a fallacy not to provide them. While I would not say that a steel car cannot be repaired outside under adverse weather conditions, I believe that the work can be carried on more successfully where shops are provided.

Second: Shops should be well equipped with suitable machinery, properly located, so that repair parts may be made economically without any lost motion or backward movement. It is a question whether or not it pays to attempt the manufacture of all steel car parts in the average railroad shop. Some of the larger railroads buy most of their car repair parts already punched and pressed into the proper shape ready for application. However, it is neces-

sary to have sufficient machinery to make odd parts or to extend the supply when exhausted, as it is almost impossible to keep sufficient parts on hand to meet all conditions.

Punches, shears, hydraulic presses, heating furnaces, and a good supply of efficient pneumatic tools, are indispensable in the modern shop and will soon repay the initial cost of installation. Sufficient compressor capacity with facilities for supplying dry air at all times, is necessary for the economic use of pneumatic tools. Proper facilities should also be provided to take care of the scrap parts that will accumulate, and the shop and surroundings should be kept clean at all times. While this may not seem important to some, nevertheless it has a certain moral effect on the workman, which should not be underestimated.

Third: Other facilities must be provided such as store houses, storage yards, air brake shops, paint shops, oil houses, etc., depending on the size of the shops. Storehouse or material supply house should be located as near the shops as possible and electric tractor service or other means installed for convenient and economical transportation of materials. Fuel supplies and stores should be under direct supervision of the foremen in charge, or if the shop organization does not permit this, the storekeeper and car foreman should be very close together and work in perfect harmony.

Fourth: Another and probably one of the most important factors in repairs to steel cars, is the quality and quantity of supervision. Sufficient intelligent supervision must be furnished or the work will lag and both the quality and quantity of the output will suffer. The gang foreman who comes into daily personal contact with every man under him is the keystone of any organization. He forms the contact point between the management and the men and when the contact is broken, the current ceases to flow. These men should be selected from the ranks, if possible, and should be men who have developed ability and initiative in their work and they should also have ability to handle the workmen. While a thorough knowledge of how to perform the work is necessary, this is not the first requisite, as ability to handle men and personality stand above this qualification. Foremen should be intelligent and fairly well educated in order that they may read the rules, blueprints and instructions and apply them intelligently, and also that they

may be eligible for promotion to higher positions as vacancies occur. Wages paid foremen should be sufficiently attractive to create an incentive for the men working under them to fit themselves for their positions. The successful supervisor, in addition to his knowledge of the work, should show loyalty toward his employer, have the courage to enforce discipline, insist on and obtain a fair day's work from every man in the service, and be absolutely impartial in handling his men, in order to obtain and hold their co-operation and respect. He should also have the vision and ability necessary to discover trouble makers and weed them out before the remainder of the organization becomes contaminated. No man should be placed in the position of foreman unless the appointing officer feels that the man selected is capable of developing the necessary initiative and ability to accept any position up to the top of the shop organization, as those men selected for the bottom round of the ladder should be capable of advancing step by step until they reach the top. Most higher supervisory officers have not the time to mingle with the workmen and they must depend on their foremen to provide the little touches of personality and co-operation that are the life of any orgization.

Fifth: Another important feature is the personnel of the shops. Wages paid and working conditions should be such that they attract capable young men to seek employment in railroad shops. Unless this is done, there is a tendency for skilled mechanics to seek more remunerative employment in industrial work. This is particularly true in the large industrial centers. The tendency prior to Federal Control in some sections of the country, due to shortage of mechanics and inability to induce young men to enter the service, has been to hire foreigners from Central and Southern Europe, men who have never had any mechanical training, and to try to make mechanics out of them. These men come to us wholly unacquainted with our language, our customs, and our laws, and must be assimilated into our organizations. While at first a rather costly proposition, with proper and tactful handling, they usually learn very rapidly, and have become the mainstay of some of our car shop organizations. It is very important that those charged with the handling of these men, should by careful and tactful treatment, instill in them the principle of loyalty to their employers and with proper encouragement and fair dealing

on the part of their foreman, the majority of these men readily become acquainted with our methods of work. In some sections of the supervisory forces were reduced to such an extent that the management were obliged to select the best of the foreigners for supervisory positions. I know one man at least, whom I believe now has the title of General Road Foreman on one of the larger systems. He developed rapidly and had the right stuff in him and they gave him a minor supervisory position; then another vacancy occurred and the boss called him in and told him he would like to give him the position but that no one could pronounce his name and that if the foreigner would change his name the company would endeavor to do something for him. He applied to the court and had his name changed and he is now a General Road Foreman. I cite this particular case to show that in some sections at least we have got to look to these men for at least a portion of our supervising force in the future. The Nationalization of foreigners has become an important subject and it is very generally conceded that they are more easily reached in the shops than in their homes. However, any tendency toward radicalism, should be carefully watched and immediate steps taken to circumvent it.

This outline of facilities, when sufficiently elaborated, should furnish any railroad with the proper equipment to keep its steel freight cars in good repair, provided, of course, that sufficient capacity is furnished to take care of its equipment as fast as same is marked out for the shop.

The only commodity a railroad has to sell is transportation. Anything that tends to increase the quantity or speed of transportation is a distinct addition to the wealth and resources of the country. Good efficient motive power may be essential, but without freight cars the railroads would have little use for locomotives. Estimating that four percent of all the cars in the country are shopped, every day of unnecessary delay in returning them to service, represents a per diem loss to the railroads of approximately $100,000.00. The importance of providing adequate shop facilities is self-evident.

In the actual work of repairs it is suggested that draft attachments and center construction be sufficiently strengthened so that the shocks incident to modern service will be absorbed and distributed throughout the car, without causing extensive damage to the superstructure. Center and draft sills should have sufficient area and should be prot-

ected against buckling by the use of cover plates. A common cause of failure is due to bodies of hopper cars not being securely fastened to center sills. A few rivets are driven in inside hopper sheets to hold the body to the sills, and the heads corrode and wear off these rivets, allowing them to pull through the sheets. This results in the whole strain being thrown on the body bolsters, which are usually of a wide single plate type, with the result that they are unable to stand up under the strain. The sills start moving back and forth under the car and it soon gets in such condition that permanent repairs becomes a rather expensive proposition. Sides and ends of steel equipment should be properly reenforced to prevent bulging out under load. Drop door equipment should be kept in proper working order to facilitate unloading. Care should be taken in repairing trucks to provide side bearing clearance and to see that brakes and all running gear is kept in good condition.

A well defined program of reenforcement should be outlined and put into practice on all roads. The cost of such additions and betterments is usually insignificant when the future life and productive service of the car is considered. Money appropriated for such features is a good sound investment when judiciously used, and should pay large dividends. Many roads make the mistake of repairing their older equipment in kind as they do not have exacting conditions on their lines. Such equipment should either be reenforced or kept on their own lines and not offered in interchange, where there is a possibility of it getting out into the large industrial centers and in heavy tonnage trains, when it is almost an impossibility to keep it off the repair tracks. This places an unnecessary burden of expense on both the owner and the handling line. As cars come into the shop for general repairs, a careful inspection should be made, and if the car has not deteriorated to the extent that it is felt advisable to scrap it, it should be repaired in accordance with a well defined reenforcement program, as outlined. Otherwise, if this is not done, after considerable money has been spent on the car, due to inherent weakness, it will again be back on the shop track.

In the matter of taking care of the work, I might add that it is the practice in some shops to use what is termed the "spot" or "specialized" system whereby one gang of men will do the stripping and another gang will do the fitting up. This means that there will be a number of gangs work-

ing on the same car before it is completed. At our shop it is the practice to have one gang complete the work. This was our former practice when our work was being done on a piecework basis, but unless you have an elaborate yard lay-out and can move the cars as the work progresses, it would seem to me that the work could be done more satisfactory than with the "specialized" system. However, at contract shops, where they insist upon and get one class of work, that is, cars of the same construction in the same series, they can use the "specialized" system to advantage, as the material coming off the cars can be used on any other cars of that series.

Another feature which should not be overlooked in the average railroad shop, is the foreign equipment which has to be repaired. As the foreign bad order cars would be placed on the shop track along with other cars belonging to the railroad, the material to repair the foreign bad order car is not always available and the delay in getting the foreign car repaired might interfere with the operation where the "specialized" system was in use.

In conclusion, if the railroads were provided with the facilities and a maintenance program similar to that suggested in the paper was adopted by all roads, and an honest effort was made to maintain the cars in accordance with that program, the steel cars in the country would give the owner a better return for the money invested, in the way of better service and in increased life of the cars.

Chairman:

Gentlemen, before we proceed with the discussion of the paper I should like to announce that we have with us tonight not only a number of Past Presidents of the club, but the Vice-Presidents of three of our railways, Messrs. Grant Hall, of the C.P.R., W. D. Robb of the Grand Trunk and S. J. Hungerford of the Canadian National Rys. It is certainly an indication of the value of the paper when we are favored by the presence of these three gentlemen. I am going to ask Mr. Grant Hall, Senior Vice-President of the C. P. R., if he will honor us with a few remarks.

Mr. Grant Hall:

Mr. Chairman, Mr. Lynn and gentlemen: It affords me a great deal of pleasure to be with you this evening. In looking over this assembly, I see some faces that are familiar

to me, gentlemen that I used to know in 1903, but there are other faces that are no longer here.

I was very much interested in Mr. Lynn's paper. I think this club is indebted to Mr. Lynn and also to the other visitors who have taken the trouble to come up here and attend the meeting this evening. There is nothing that can produce more interest in your club than papers of an interesting character, especially when they are presented by representatives of railroads in the United States.

Mr. Winterrowd has taken me by surprise somewhat. I am just an ordinary member of your club and should like to be considered as such. I should like to feel that I can come here to any meeting and not to be called upon to speak on any subject unless I felt that I was qualified and really desired to speak. However I have not been here for some time, and I suppose that is why Mr. Winterrowd has taken this advantage of me.

Speaking of the versatility that seems to be looked for in railroad officers, not very long ago I was with our President (who is a very good speaker) in a certain town in Ontario. He was called upon suddenly to address some people and the expressed some diffidence about it by saying that he had found on the trip that railway officials were supposed to have a knowledge of everything not only of railroading but even of women's apparel. He said: "Perhaps it will not be overlooked if I do not express some knowledge of the railway business, but being a Bachelor President it will not be out of place if I do not say anything about women's apparel — Laughter.

Not long ago I was asked by a friend of mine, who had taken suddenly sick, to represent him and speak at a meeting of — I think it was either the Kiwanis or Rotary Clubs — I said to him "I am not a speaker, and when I get up to talk, I forget what I want to say, and if I did remember it I couldn't say it anyhow." He said, "You get up and talk about something you know all about, — your own particular business. They wont know anything about it." — Laughter.

It may not be known to all of you that I came up through the Motive Power Dept. and am therefore naturally interested in Mr. Lynn's remarks but I was especially interested in his statement that all the railways have to sell is transportation. I want to impress this especially on you younger men. You all know, to some extent, that the rail-

ways have for the past few years been on trial. Transportation, as Mr. Lynn says, is all we have to sell, and transportation depends on good service. The only and highest justification, when all is said and done, is the good service that is given to the Patron and it is up to every rail road man, regardless of his position, to see that so far as he is concerned, the very best service is rendered.

This club is, when all is said and done, cosmopolitan in its nature. I notice in reading over the different papers that most of them are on mechanical subjects. Mr. Bell of the Grand Trunk, for instance, has consistently attended the meetings and yet he is a member of another department. It seems to me it would encourage the different departments if more of the papers which are presented dealt with general subjects, as this would tend to increase the membership and also the efficiency and usefullness of the club. I do not know that I can promise to always be present at your meetings, but if you will undertake that you will not ask me to talk when I do come I think I would come more often. I do not know that I can say any more to point out that as railroad men today we are faced with extraordinary problems. I am more familiar with the methods in the west than in the east having spent more time in that part of the country. I was impressed with the story told by one of our conductors a short time ago. He said, "You have been pressing us pretty hard to get all the earnings of our trains." I replied, "Yes, we are." He said, "I was up against a proposition the other day. I started to check up my train when I came across a lady sitting with a boy who appeared to be about 14 or 15 years of age. She insisted that he ought to travel at half fare, but I told her the boy appeared to be over age and there was nothing doing. The lady then made the claim that they ought to travel at half fare as he only had short pants on, but I collected full fare. I passed on down the aisle and a young lady sitting a couple of seats back who seemed to be very much interested in the conversation with the lady said to me, "I notice you did not let that boy travel on half fare because he had short pants on." I said, "No," "I was thinking" she said "that if it came to short costumes perhaps I might get by too." — Laughter.

Chairman:

I wish to say that we all appreciate greatly and value

most highly what Mr. Hall has said. I mentioned the fact that we have with us to-night the three Vice-Presidents of the ranking Canadian Railways. It is an interesting fact that they all started at the bottom of the ladder and came up step by step, and all came up through the Motive Power Dept.

Mr. Robb, I wonder if you would be kind enough to favor us with a few remarks?

Mr. W. D. Robb:

Mr. Chairman and gentlemen, I really do not think it is fair to ask the Vice-Presidents who are here to make speeches, because when they come here they come to listen, and besides if we are all going to be called upon to make speeches you will not be able to get through your regular business. I feel like Mr. Hall that I would be more inclined to come to these meetings if I were not called upon to say anything, and on this special occasion I would rather not speak but would prefer to listen.

I am agreeably surprised to see such a large attendance here tonight. This club has certainly grown since I was its President, and I believe the attendance and the enthusiasm is due largely to the energy of your President. He wrote me several letters asking me to be here this evening, and I have no doubt he wrote other gentlemen in the same manner. By this means you are able to have such a splendid attendance, and I congratulate you on having such an able President and the manner in which he conducts the business and meetings of the club.

I am not going to take up much of your time as I know you have a lot of business before you, but I must say I was very much interested in this paper on repairing steel cars, having in mind the number of cars of this class that are owned by the roads to the south of us, and I feel that we have considerable to learn in the repairing of this class of equipment.

I told a little story before I came here this evening about an honor that was conferred upon me some time ago and which I am proud of. At the time the Prince of Wales visited Montreal, as you know, there was a luncheon given in his honor, and Mayor Martin, being a friend of mine, I was invited to the function. After the luncheon the Prince addressed the audience, and in order to hear him better I got up on the platform directly behind the Mayor. When the Prince had finished the Mayor turned around and

seeing me there, said, "Ah, my friend, Mr. Robb. I must introduce you to His Royal Highness." He said, "Your Highness, allow me to present my friend, Mr. Robb, Vice-President of the Canadian Pacific Railway." — laughter, —so you see I have been honored by being named a Vice-President of the C. P. R.

I am a Motive Power man, but have started now, in the latter years of my career of my life to learn operating. So far as the repairs to steel steel cars are concerned. I have not been directly in touch, to any great extent, with the steel repairing car business, and therefore am not very familiar with the repair to this class of equipment.

When it comes to repairing and operating steel cars I feel very much like the Scotchman who met a friend of his one morning and said, "Jock, I was at a lecture last night, and it was fine. A man lectured for an hour and a half and it was very entertaining. It was on Metaphysics." Jock replied, "That was a good subject, mon, but what are Metaphysics?" "Do ye no ken what Metaphysics are Jock? Mon, I'm surprised at yer ignorance. It is a subject in which I explain to you carefully, fully and intelligently something that I know nothing about myself." — laughter and applause.

Chairman:

Is Mr. Hungerford here?

Mr. T. C. Hudson:

Mr. Chairman, Mr. Hungerford was obliged to leave the meeting just after the paper had been read in order to catch a train for Toronto. Before going he expressed himself as much pleased with the paper, and was sorry he could not stay longer.

Chairman:

Mr. Hall and Mr. Robb, we appreciate very much the words you have spoken to us tonight. I can assure you personally and on behalf of the club that we are glad of have you here and appreciate your kindness very much.

The paper is now open for discussion, and I will ask Mr. Justus of the New York Central to open the discussion.

Mr. I. J. Justus (N. Y. C. R. R.):

Mr. President and members, Mr. Lynn has given you a paper which clearly reflects his appreciation of the importance of the problems incident to the repairs and proper maintenance of steel freight cars.

I have thoroughly enjoyed listening to his treatment of the question and I believe that Mr. Lynn's conclusions are of distinct value to every man interested in this branch of railroad work.

At one point of his article Mr. Lynn spoke of the deterioration of steel cars caused by age and the ordinary wear and tear in daily service which necessitated extensive repairs. Naturally this problem is fundamental and universal. One might say that it is the crux of the whole subject under discussion, and as it has been the basis for some investigation on my part, may I, with Mr. Lynn's permission, summarize briefly the results of the work, which may be of interest?

Last summer we had several hundred steel hopper cars stored at West Detroit awaiting heavy repairs in a contract shop. At this time there was a critical shortage of open top equipment and two Government inspectors reported that a number of these cars were fit for service with trifling repairs and that they should not have been taken out of service.

I was instructed to go to Detroit and make an inspection of these cars and ascertain if they were still fit for service and should not have been sent to a contract shop for rebuilding, or whether their structural strength had been so impaired by loss of weight that the fibre stress on certain parts had been increased to a very undesirable degree.

These cars were built in 1909. I had a number of them thoroughly cleaned and then weighed bodies and trucks separately, and found that the bodies had lost from 2,300 lbs. to 3,540 lbs. in weight, or from 13% to 16%. I selected for this purpose some of the stored cars that were in the best condition and some that were in the poorest condition, the average loss in weight being between 15% and 16%. I then had several of these cars cut down and weighed the individual parts and made a comparison with the weight of items of new material applied which had passed through all necessary fabricating operations on the shear, punch and press, and were completely finished material ready for application to the car. These items of material were similar in design and size of material to those originally applied to the cars.

COMPARISON OF WEIGHTS.

New or second hand material applied and scrap material removed—N. Y. C. steel hopper and gondola cars repaired by A. C. & F. Co., Detroit.

100% *New Material—Lot* 231-*H.*

Description of material	*Unit Weight Scrap*	*Second hand*	*New*		
Hopper Slope Sheet	305		550	45%	Deprn.
Longitudinal Ridge	82		186	56%	"
Cross Ridge	185		305	39%	"
Floor Sheet Center	45		117	61%	"
Hopper Sheet Side	45		119	63%	"
" " Center ...	30		91	67%	"
" Door	65		99	34%	"

About 50% *Old Material Reapplied—Lot* 231-*H.*

Side Sheet—Inter	220	313	450
" " —Center	220	320	450
" " —End	90	118	133
" Stakes		41	63

About 90% *Old Material Reapplied—Lot* 231-*H.*

End Sill	170	193
End Sheet	170	245
Bottom Side Angle	185	205
Top Side Angle	160	168

Mr. S. Lynn:

Replying to Mr. Justus, would say that the data which he has presented is certainly very interesting. It is the practice in most railroad shops to reclaim all portions of the car that are suitable for further service, however, care should be exercized in the reclamation of certain parts to see that material is not put back on the car which has probably deteriorated to such an extent that it will have to be renewed within a short time, which would require that considerable money again be spent on the car, whereas, had new material been used when it was given general repairs the first time, the saving effected, considering the money spent the second time in order to renew the reclaimed parts, it would have been better to have used new material on the car and use the parts that were fit for further service from this car on some other car where the

repairs needed were not as extensive. However, this is a detail matter and must be followed in each shop in order to get the best use of all material and at the same time do what is necessary to get the car in shape for the service intended.

Chairman:

We have with us to-night a number of mechanical officers from the roads to the south of us. Will Mr. Oviatt, Gen. Mech. Supt. of the New York, New Haven and Hartford R. R., favor us with a few words.

Mr. H. C. Oviatt (N. Y., N. H. & H. Ry.):

President and members of the Canadian Railway Club—I am so full of appreciation for the hospitalities shown me since my arrival in your city that before attempting to comment upon the paper of the evening I wish to express to the president and members of this club my full appreciation and thanks for the privilege of being here. The number in attendance not only indicates the interest of its members in the work of the club, but also the congenial personality and efforts of its officers, as through them alone can a club of this kind be made sufficiently attractive to induce such a body of busy men to give up their time to attend. Also, the attendance and remarks this evening of some of the principal executive officers of the leading railroads of Canada is further proof of the benefit this club is to the railroads.

The object of railroad clubs is primarily for the purpose of exchange in ideas upon railroad subjects for the common good of all who have to do with the handling of such problems, and as little is left by the speaker of the evening in his paper to criticise, I will take a few minutes of your time in describing conditions surrounding the freight train equipment owned by the road with which I am connected, and which is no different from many roads in the country.

We have a total of approximately 3,700 freight train cars, 8,800 of which are all steel open top, the remainder being principally steel underframe box cars. At the time railroads were taken over by the Government, the New Haven Railroad was exceedingly fortunate in having all of their equipment in first class condition.

It is well known that freight cars during the past two and a half years have been pooled and the owning roads have seen very little of their equipment, the New Haven Railroad operating as low as 8% of the total home equipment to the cars on the line.

Not long after the roads were returned to the owners, freight cars began to return, and with the depression of business, such equipment returned in increased numbers, either under the car service rule, or specially marked home for general repairs. While the facilities on the New Haven road are adequate under normal conditions to take care of the box car equipment, it had not provided for the general repair to all-steel cars.

From the fact that many of the open top cars were purchased as early at 1906, 1907 and 1908, it was realized that provision must be made for making repairs to these cars. Our General Car Inspector and Shop Superintendent were delegated to investigate shop equipment of other roads, for the purpose of gathering such information as would assist us in selecting the best shop arrangement and tools for doing this class of work, but little information was obtained, as few of the roads visited were properly equipped for repairing this type of car. The financial condition of the New Haven Road, like many others, was such that it could not make an appropriation for the erection of new shops of a capacity to meet the requirements. After further study of the situation it was decided to open one of the recently abandoned roundhouses and a building formerly occupied as locomotive and car shop, making necessary alterations and installing in same equipment and tools for handling steel work.

An appropriation of $170,000.00 was approved for repairs and alterations and the purchase of tools, which included, in addition to pneumatic and other small hand tools, such machine tools as McCabe flanger, press, straightening rolls, flange clamp, bolt cutters, steam hammers, journal truing machines, punch and shears, oil furnaces and blacksmith forges, electric tractors, air compressors, etc., together with overhead air hoist and jib crane for handling the work through the shop.

Each shop was organized with a competent foreman and sufficient forces to operate at full capacity, and being located at extreme ends of the line, as well as under different management, a considerable rivalry sprang up between the two organizations, resulting in increased efficiency and minimum cost of production.

The operation at each point is so arranged that inspection is made of the equipment before going into the shop, and each part that is to be removed, marked. At the same time, an order blank is filled describing sheet numbers that will be required, and the cars are then placed on stripping pits, where a stripping gang removes sheets by use of oxy-acetylene

torches, pneumatic guns, etc. Scrap sheets are then unloaded by the use of air hoist, and immediately removed by tractor truck equipped with one ton crane. The new sheets are returned by the same truck and placed in car. Cars are then removed to another section of the shop, where assembling alone takes place. By this method scrap is kept out of the shop, permitting work to proceed with minimum interference, and having material close at hand when assembling begins.

Material used in repairs is fabricated at the mills when purchased, at it could not be done at the company's shops. On this basis each shop is turning out five cars a day, with repairs to superstructure that will extend the life of same to a minimum of five years, and in many cases, a much longer time. The car also receives a general overhauling of trucks, draft gear, couplers, and necessary repairs to bolsters, undersills, etc., at the approximate cost of $863.00 each, covering labor, material and overhead.

With the assistance of small orders given to outside contractors, we have been able to not only reduce the number of bad order open top cars on the line, but are taking care of those returned currently. My explaining the above operations is simply to illustrate results that can be obtained by the use of facilities already at hand, with a small outlay to cover proper equipment, together with efficient organization, making large capital expenditures unnecessary.

Unlike repairs to locomotives, the handling of repairs to freight train cars by designating cars requiring various classes of repairs to individual shops, has never been considered. In order to handle this subject in a more systematic way a thorough canvass was made of our system to determine the number of each class of repairs turned out daily, the forces engaged, material in stock, and adequacy of means for handling.

Our investigation showed that while we were prepared for handling light repairs, we were not equipped to handle heavy repairs advantageously. I therefore decided to organize forces to take care of a particular class of work, and arranged accordingly, supplying the material necessary for the class of work that would be carried on at each point and with necessary forces. On this basis, our heaviest repairs, including classes 1 and 2, are ordered to the point where they can be economically handled. Lighter repairs, such as 3, 4 and 5, are likewise handled at points which do not require tools for heavy class of work. With this arrangement it is possible to assemble at each point, material required for the particular

class of repairs. At the same time, the forces become familiar with the routine work, increasing production at minimum cost.

Each class of repair is considered on the man hour basis, permitting of a close check of the efficiency of each plant, also allowing the supervising officers to determine the efficiency of the forces as a whole.

I concur with the speaker that an important feature is "the personnel of the shops, with wages paid and working conditions should be such that they attract capable young men to seek employment in our railroad shops," and believe that the wages now paid are sufficient to attract all who desire this class of work. These rates were authorized by the Labor Board, who apparently gave consideration to all the conditions surrounding employment of such forces

The question of supervisory forces should be decided by the railroad company alone, and the educating of such men should be given careful consideration in the future, as it is too important a matter to be overlooked.

I thank you.

Chairman:

We also have with us to-night Mr. J. J. Tatum, Superintendent Car Department, Baltimore & Ohio Railroad Co. We will be very much interested in any information he is able to give us.

Mr. J. J. Tatum:

Mr. President and members of the Canadian Railway Club, I would like also to express my appreciation of the hospitality that has been shown to me this evening, and to others from the States. The same hospitality has been shown me on a former occasion, but as I feel I am unable to tell you all of my appreciation. I will not attempt to make further statement, but will give you some information on Baltimore and Ohio steel cars.

I have read with a great deal of interest Mr. Lynn's paper on "Repairs or Maintenance of Steel Freight Cars."

The conclusion of one interested in the subject may ask the question: "Why be it so important?" The answer to this may be: "Something has been neglected." And this question may rightfully be asked, because the repairs and up-keep of steel freight equipment would have been less troublesome, and expensive, if there had been no neglect.

The neglect I have in mind is the failure of the engineer

to make the same progress with the steel freight cars as the automobile builder did in the development of the automobile. . A structure is only worth for service, the service value of its foundation. If a well provided foundation is given the structure, good results generally are obtained. If the foundation is poor, and neglected, then the structure is only worth the value of the foundation, regardless of how substantial it may be.

WHAT IS VITAL OF THE STEEL CAR?

Answer—To improve its service. lessen its repair and cost.

The answer to this question may be: . . . . . .

First—A well designed underframe, with sufficient strength to meet the requirements of the service it is subjected to, such should be had, regardless of cost.

Second—Material of proper quality used in its construction.

Third—A draft gear made use of that will function properly, and afford needed protection.

If the three above fundamentals of steel car construction had been provided, our maintenance would have been less, and our cars less frequently shopped. The light weight of the equipment would have been less, and a greater revenue ton trainload would have been possible, because of less dead weight to haul.

Steel used in steel cars is not as good and valuable for service as similar material that was used in iron cars, 50 or 60 years ago.

It may be that some, or all of you, are familiar with the fact that the Baltimore & Ohio built iron box cars as far back as 1862; the super-structure was made of iron plates and angles, the underframe of wood. Only recently an investigation of one or more of these cars developed very little deterioration in the metal plates, because the material was of proper quality.

For the purpose of establishing more information concerning metal plates, a smoke stack was removed from an old rolling mill, located on the Baltimore & Ohio, at Cumberland, Md. The metal in this stack was placed in use about 40 years ago, and showed practically no depreciation, yet it was exposed to the elements and sulphuric acid supplied by heavy atmosphere at a large railroad terminal.

The analysis of the metal of this stack was about the same as that of the box car above referred to, which showed the

metal containing about one-half of one percent of copper, or the following:

(1)—*Old B. and O. Box, built* 1862:

Carbon	Very low
Sulphur	.020 per cent.
Phosphorous	.034 " "
Manganese	None
Copper	.54 " "

(2)—*Cumbld. Smoke Stack, placed in use* 40 *years ago.*

Carbon	.012
Sulphur	.030
Phosphorous	.177
Manganese	.05
Copper	.44

(3)—*Copper Bearing Steel, present date.*

Carbon	low
Sulphur	.040
Phosphorous	.008
Manganese	.38
Copper	.25

(4)—*Hopper Steel, present date.*

Carbon	.18
Sulphur	.045
Phosphorous	.0156—.035
Manganese	.50
Copper	....

Compare the service of the iron car with the steel cars of to-day, the steel plates lasting from 12 to 15 years. This steel shows no copper. Some of these steel plates in passenger cars are deteriorating beyond use in 10 years.

I am sure the above information presents an alarming situation, and one that is already greatly responsible for high maintenance expenses, and will continue to be great, unless a solution is found, even if the initial cost be greater.

Would it not be cheaper to pay 25 percent more for your equipment, and have it to give you 100 percent or more service?

Therefore, I think it would be wise, if our car builders, with their responsibility, would recommend:

First—Steel cars to be built of iron or steel, composed of at least one-half of one percent of copper.

Second—That all material subjected to heavy shocks and loads be heat treated by "quenching" in order to increase its strength.

Third—The necessary sectional area be established in the underframe of car constructions, to withstand the shocks they are subjected to.

Fourth—A substantial friction draft gear be made use of; one that will absorb the shock and relieve the structure.

Fifth—That the weight of car be reduced to the minimum commensurate with the strength necessary, which can be established by the use of better materials, heat treated.

There are other causes adding to the frequent shopping of cars at increased cost of upkeep, one of them being the use of weak cars in heavy steel trains: "A chain is only so strong as its weakest link."

Therefore, wooden cars with light drafts in heavy steel trains result in frequent derailments, damage and destruction of property. We should strive to overcome these difficulties by applying reinforcements to the weak equipment or retire it from service.

The following represents the number of weak constructed freight cars in use on all class 1 railroads in the United States January, 1920, and the estimated cost of strengthening them to meet the requirements of the service in heavy steel trains:

(1)—Cars equipped with short wooden draft timbers extending from front of body bolsters ..	192,751
(2)—Cars equipped with metal draft arms, extending from front of body bolsters	54,818
(3)—Cars equipped with wooden draft timbers, extending beyond body bolsters	120,979
(4)—Cars equipped with continuous metal draft sills, or arms	71,950
(5)—Cars equipped with continuous metal draft arms, without cover plates, either on top or bottom	48,537
(6)—Cars equipped with steel center sills, without cover plates	94,273
(7)—Cars equipped with metal draft arms, extending beyond body bolsters	165,455
(8)—Cars equipped with Commonwealth Steel Castings, Company's Transom Draft Gear without metal connections between body bolsters	16,840

(9)—Cars equipped with Commonwealth Steel Castings, Company's Transom Draft Gear with metal connection between body bolsters 18,872

(10)—Cars equipped with steel center sills with short metal draft arms attached to the underside in front of body bolsters 27,922

To reinforce the cars in items 1, 2 and 3, with steel center sills, it was established, would cost $616.70 per car, or $227,283,551.00 for the 368,548 cars affected.

To equip the 71,950 cars as referred to in item 4, with steel center sills, would cost $492.21 per car, or $42,609,509.00 for the 71,950 cars.

To apply cover plates to the steel center sills, shown in items 5 and 6 above referred to, it will cost $107.11 per car, or $15,296,379.00 for the 142,810 cars.

To equip the 583,308 cars shown in items 1, 2, 3 and 4 with steel center sills and items 5 and 6, with cover plates, the estimated cost will be $285,189,439.00.

If the cars are to be kept in general use over the entire country, the equipment above referred to should either be dismantled or the reinforcements applied.

STATEMENT OF BALTIMORE & OHIO RAILROAD COMPANY'S STEEL CARS SHOWING DATE BUILT, DATE OF FLOOR PLATES REQIRING RENEWALS, AND DATE OF SIDE PLATES REQUIRING RENEWALS.

Serial Number	Class	Date Built	Age of cars in years	Floor Renewed	Age of Floor Renewed	Side Renewals	Age of Side Renewals	Size of plate
25450-25999	P & W-550	1898	23	1913	15 yr.	1916	18 yr.	1/4 in.
26000-26999	N- S-1000	1899	22	1913	14 yr.	1916	17 yr.	1/4 in.
20000-23999	N- 9-4000	1900	21	1913	13 yr.	1916	16 yr.	1/4 in.
120000-123999	N- 9-4000	1902	19	1914	12 yr.	1916	15 yr.	1/4 in.
124000-125999	N-10-1000	1905	16	1920	15 yr.	1920	patched	F 5/16 in. S 1/4 in.

NOTE: F Floor; S Side.

Mr. S. Lynn:

Mr. Tatum has taken exception to my statement about the steel car not being in use more than twenty-five years, and to prove his case he states that the Baltimore & Ohio Railroad built some iron or steel cars fifty or sixty years ago. I do not question his statement about the Baltimore & Ohio having one or more cars in service the length of time he states that were of all metal construction, material used being iron or steel, but I still maintain, however, that the steel cars were not in gen-

eral use until within the last twenty-five years. I understand that during the Civil War the Baltimore & Ohio had one or two special cars which were used for a test to see what results they would give under certain conditions, but as Mr. Tatum says, they lost the cars, it is evident that they did not stand up to the work. The steel car first came into the game in 1898 or about twenty-five years ago, and speaking generally, that was the time the steel car was developed and put into general use. There may have been a few iron cars used for special purposes, but in the case of the steel car for general purposes, I stand by the statement in my paper as approximately correct. Mr. Tatum has referred to the quality of the material which is being used in the car and I concur in his views on this subject.

I think it was about five years ago that I had the privilege of reading a paper before the Pittsburgh Railway Club, in which I made the statement that in my opinion the steel we were getting in our cars at that time, and which we were also using for repairs, did not have the lasting qualities or the life that the steel had which was used in the first cars built, and some of the steel manufacturers took exception to the statement at that time. However, I have not changed my opinion and I understand that it frequently happens when orders are placed for news cars, that the railroad company will submit specifications for the kind of steel they desire to be used in the cars. The builder will furnish the steel specifications to the steel manufacturer and they are frequently informed that they cannot furnish the steel according to the specifications and they will either have to take stock steel or the manufacturer will cancel the order. This would indicate that the railroads cannot always get the quality of material that they would like for their requirement.

While I am in receipt of some information with reference to the copperized steel, as mentioned by Mr. Tatum, I do not have sufficient information regarding it to be able to say whether or not the use of this material would increase the life of the steel used in the cars.

Mr. J. J. Tatum:

Mr. Chairman, Mr. Lynn stated that the Baltimore & Ohio had perhaps one car; indeed, I have been with the Baltimore & Ohio for 42 years, and we had something like 100 or more of these cars in service. They were not built for experimental purposes, but for general service. During the Civil War, when the cars were first built, they were con-

sidered very valuable for hauling powder. After the Civil War they were put into the merchandise business and hauled flour, grain and other freight of that character.

These cars were lined with wood on the inside about ½ the height of the sides, and after they were found not satisfactory for grain and merchandise, we used them for hauling bulk lime. The sweat from the sides slacked the lime, which resulted in burning the wood floor and lining. We then removed the cars from this service and placed them in the service for hauling cord wood and lumber, mine props, bricks and similar freight. They proved very satisfactory for this service.

Mr. Norman Holland:

Mr. Chairman and gentlemen,—

Some time ago a party of friends of mine was obliged to spend a week in Toronto, and one evening we endeavored to get a few people together for a friendly game of Bridge, but there was difficulty doing this: Someone suggested that we go over to the cemetery and dig up a few friends — laughter. This condition, you probably have observed, does not pertain to the Canadian Railway Club at Montreal. We do not have to call on the "tombstones" to get a good meeting.

On page 26 "Doctor" Lynn refers to the practicability of painting the steel car. Mark Twain tells a story of a boat on the Mississippi where the signs that had been painted on the side lasted for eighty five years. The sign did not wear out but the woodwork all around it had disappeared. If we could only get paint like that, you could paint your hopper cars inside and they would handle slag, coal or any other commodity, but I would not want to have to pay the bill for the paint.— Laughter.

Mr. Grant Hall spoke about talking on a subject that you do not know anything about. It reminds me of the lecturer some years ago who was talking on the subject of Madagascar. He first asked the audience if any of them had ever been there, and upon receiving the reply that they had not said: "Then I am perfectly safe in talking to you about it." — Laughter.

We often hear stories about the trouble due to freight cars getting lost, and it is said they are very much like pins and if that is the case you cannot blame them, because

pins are "headed" in one direction and "pointed" in the other.—Laughter.

There is considerable rivalry between the cities of Toledo and Cleveland. "Doctor" Lynn's reference to Pittsburg, reminded me of the story of the fellow from Toledo who attended the metting at Cleveland to discuss certain municipal problems. The Toledo man was blowing up his city, telling of its advantages, and pointed out that it would be a much larger city if it was only on the lake. The fellow from Cleveland replied, "All you require to do is put a pipe line from the Lake to Toledo and if you can suck as well as you can blow, you will have the lake there in no time.—Laughter.

"Doctor" Lynn spoke about a foreigner, a railway employe, changing his name. It reminds me of the Irish policeman in New York who had to make a report of a horse having died on the street. He made the report but left off the name of the street. His superior officier asked him what the name of the street was and he said, he couldn't spell it. He was told to get busy at once and make out his report properly, showing the name of the street. He went away and a few hours afterwards come back covered with dirt and muck, and upon being asked by the officer where he had been said, "Be gorra I had to drag that horse over to 5th Avenue".

The Chairman:

We have with us tonight, one of the past Presidents of our club, and Vice-Chairman of the Mechanical Section of the American Railway Association, Mr. James Coleman, whom I will ask to say a few words.

Mr. James Coleman:

Mr. Chairman and gentlemen,—

I did not expect to be called upon to speak tonight. I certainly feel that the Canadian Railway Club are under obligation to our friends from the States who have come here to visit us, and we are especially obligated to Mr. Lynn for his splendid paper. While the Canadian Railway officiers who are responsible for the maintenance of steel cars have not had the amount of experience with steel cars that the American roads have, I am sure we are all glad to have these gentlemen come here and get the benefit of their views and experience. The life of the steel car

depends upon the design and the strength of the parts put into the car. Many cars have been built by railways which, after they had been in service for some time, were found too light in design and construction for present day service, and by trying to reduce the tare weight, the life of the car was very much shorter than the car designed with the heavier carrying members and able to withstand buffing shocks. The classification of repairs cannot be uniform because the conditions are not uniform, on account of the construction of the cars not being the same. This climate requires a heated shop for men working on general repairs during the winter season. The number of steel cars on repair tracks is increasing, due to the decayed condition of the cars requiring shopping, if built in series, all about the same time, and the reason railways have not been spending the money during the last five years to maintain equipment was on account of war conditions. You are going through the same experience that Europe went through in the early 60's. When they started to build metal cars they did not have much experience, but after building the light car they found out their mistake, and made a heavier car to get a longer life and decrease the the cost of maintenance. I believe railways see the necessity of building a car to stand the service conditions, and fix about 24 years as the expected life for all steel cars. The past few years' experience has been beneficial to all concerned in determining a more set policy for maintaining equipment. I do not quite agree with Mr. Lynn and Mr. Tatum as to the quality of the metal—it does not seem possible to get it at all times. The railways will have to build composite cars of steel and wood for some time to come, for the reason that house cars of this construction are more serviceable than all steel in this climate, and I believe more economical. Also it is a fact that the use of the steel car in many sections of the United States is entirely different to what the general practice is in Canada. Many railways in the United States use their cars for storing coal during the winter months. The loss of the use of the car, the deterioration which takes place in the body of the car due to sulphuric acid water dripping through the car from the coal decreases the life of the car very materially, and requires shopping for general repairs in practically one half of the expected life of a car that is not used for this purpose. All railways accep-

ting cars at interchange points, whether all wood, all steel, or composite construction, are just as responsible for the return of the car to the owner as they are for their own. While it is true that the owner of a foreign car is billed for the maintenance of the car on foreign lines, it is a fact that railways handling foreign equipment do not give this equipment the same attention that they do their own. This fact is one of the reasons for the condition of a good deal of the foreign equipment now floating all over the country. Railway clubs all over the country have been giving a good deal of time and most interesting papers have been read on the repairs of cars and maintenance of equipment generally, enlarging on the reasons for the condition, recommending some standard practice and policy to maintain it, but no consideration has ever yet been given as to where the executives are going to get the money to spend on maintaining equipment. Members of all railway clubs, who are in mechanical departments and are responsible for maintaining equipment, are spenders of the money, and not direct earners of revenue. I was very much interested in listening to Mr. Hall and Mr. Robb, and we are glad to have them here tonight. They are responsible in a measure for providing the money to spend on maintaining equipment. Many times this evening I have wondered if we all realize the conditions that railway executives are facing all over the country at the present time. The only means that railways have got for earning money,—the issuing of tariffs by the traffic departments to the public and manufacturing districts in soliciting business—has got to be approved by a commission before such tariffs can be approved. The money authorized for expenditure by executives for maintenance of equipment, and the rates paid for all classes of help—all this is controlled by a Board authorized by Congress in the United States, and railways in Canada are in a great measure compelled to carry out the same policy. Railway executives today require more sympathy than censure. They will have heavy problems confronting them during the next few months, and they will require the loyal and hearty co-operation of every man working in mechanical department to assist them in solving these problems.

Chairman:

We also have with us another Past President, Mr. George Smart, of the Canadian National Railways.

Mr. G. E. Smart:

Mr. Chairman and fellow members:—I am sure we are all pleased to see so many here this evening. The answer to the importance of Mr. Lynn's paper is the attendance here tonight. The subject of maintenance of steel freight car equipment is a very live subject to anyone connected with the Mechanical Department and it is my opinion that we have over-estimated the all steel car and that better results can be obtained by building a composite type of freight car; the composite type of car can be built to meet the service in which the all steel car is now used, and as a coal car it is preferred in sections of this country where the coal is high in sulphur, as the side sheets, doors and floors of the all steel cars only last seven to ten years, whereas a composite type with wood sides and floors will last from 15 to 20 years.

In further considering this subject. Maintenance of Steel Equipment—we must look back to the day the cars were built. The steel used in the construction of the car represented a price of 1½ to 2½c per pound and labor from 25 to 30c per hour and it is a very costly operation to renew the side and bottom sheets on this type of car, with steel at 4 to 5c per pound and labour at 80c per hour. Mr. Coleman mentioned in his remarks how the Railway Executive Officers were handicapped in many ways in providing money to maintain equipment, and you can see from this comparison which I have made what it is to maintain steel equipment.

There are thousands of cars built a few years ago with underframes too light to meet the present day yard switching and train service due to the heavier motive power, and coupled with these are the All-Steel Cars that have deteriorated due to corrosion to such an extent that the entire body requires renewing.

The Mechanical Officer must arrange for an economical system to follow and in my opinion this is to set aside the different series of cars that are in this condition and order materials so that the entire series can be repaired at the one time instead of allowing the cars to be patched up year after year as it will cost more to patch in this manner and the Railway will only have a car that is not fit for heavy train service. I might say that out of a total of over 78,600 freight cars on the Canadian National Railways we have less than 1000 all steel freight cars but we have over

24,700 composite type cars and we are applying metal draft arms as quickly as possible to the all wood equipment —in fact last year in our own Shops 5000 cars sets were applied.

Reference to Steel Passenger Equipment. I am of the same opinion that all steel passenger cars are not as economical as the composite type. The Canadian National standard for passenger cars is steel underframe , and superstructure, steel sides and ends, wood and canvas roof and wood interior. The wood and canvas roof will give from 25 to 30 years service as against 10 to 12 years for the all steel roof, and the wood interior finish is a better insulator in extreme cold climates and cooler in summer. The construction of new cars, both Freight and Passenger, governs to a very large extent, the maintenance of the equipment; proper designing of the car and the proper method of painting of the steel in passenger and freight cars when same are being built will cut down the repair bills. It is only of recent years that the interior of the side steel sheets of passenger cars were sand blasted and painted and the result today, due to the frost and moisture on the interior of the sheets and the wet insulation from the moisture, being in contact with the side steel sheets, is that corrosion is taking place on the interior of the side sheets and cannot now be prevented. The same applies to the all steel roofs on passenger cars. In many cases the corrosion is such that only a thin shell remains.

The steel freight and passenger cars require more care than the old wood cars and the life of the car depends on the way you treat it. If you don't take care of it at regular intervals it will not last as long as it should. The steel car requires painting at regular periods and more particularly the underframe, and it is no use painting unless the scale and rust is thoroughly cleaned off and the best method is the sand blasting.

Mr. President ,as the hour is getting late. I do not wish to continue further with this discussion but wish to congratulate Mr. Lynn on his valuable paper and your efforts in obtaining Mr. Lynn to read this paper before the club.

Chairman:

We have with us to-night a gentleman who read a paper before the Mechanical Section of the American Railway

Association at the Annual Convention at Atlantic City last June, and a paper before the Western Railroad Club, on the Selection and Training of Men. I know of no man who can speak on this subject in a more constructive and inspirational way. I refer to Mr. G. M. Basford.

Mr. G. M. Basford:

Mr. Chairman and gentlemen,—

Cars and locomotives must be regarded as an enormous investment the earnings from which increase in exact ratio to the percentage available for service. There is no problem now before railroads as important as the production problem in maintenance.

Until we compare the steel car of today and the improved locomotive of today with the car and the locomotive of, say, twenty-five years ago, until we compare the loads they take and the loads they haul we do not give credit to improvements justly due to them. Some years ago I had the honor to be present at a demonstration in one of the largest terminals on the other side of the line of an engine starting and hauling a train of 600 tons. Newspaper men were much impressed with the performance although the engine involved had to have help from an unseen switcher to get the train going. How insignificant does a train of 600 tons seem now? For many years cars and locomotives grew bigger and heavier and more efficient. Steel cars revolutionized the handling of freight and improvements increased the capacity of the locomotive. The Railroad Age announces the construction for a railroad in Virginia of 1000 120-ton cars. This road has highly specialized conditions of operation and has increased its train loads from 7,950 to 13,200 tons. It is given to but very few roads to haul such trains, but this case turns our thought to the remarkable improvements which have been made, improvements in which the steel car is fundamentally a part. Other roads with other conditions have increased their train loads tremendously though not as much as this. If we were called upon today to handle traffic when business is good, with the equipment of a generation ago, or before the Canadian Pacific took the lead in superheating, the public would understand much that is not now understood concerning the improvements railroads have made.

The next thought is that big large capacity steel cars and locomotives that are not merely big and heavy, but are

also highly efficient, have made it possible to meet the transportation needs when those needs were greatest — couldst thou both eat thy cake and have it! We therefore must face the problems that these improvements have brought. We must maintain and keep in good condition the equipment that has done so much for transportation. Big expensive cars and big expensive locomotives must not be kept idle for lack of adequate shops, machinery and facilities for quick repairs. No other business could stand it. The railroad business cannot stand it long. It has always been easier to get new cars and new locomotives than to supply facilities for maintaining those we already have and for improvements in operating them. Today transportation faces new conditions. New methods are called for and what is needed most of all is to improve the equipment now in use and get more use out of it. Maintenance facilities are the most desperate need of railroads on the other side of the line. I know that Canada is different from the United States but perhaps this expression may do no harm in Canada. If cars and locomotives were like bridges as to maintenance this question would not arise. Bridges must be kept up for safety, whereas cars, also locomotives, will usually make another trip before falling apart.

It is fair to say that no structure designed by engineers was ever so well adapted to hard, rough, uncompromising service as in the modern steel car. These structures are a tribute to engineering guided by experience. They earn the money for the road and therefore they merit the care necessary to keep them to their work.

This calls for facilities for shops, machinery, appliances, cranes, hoists that few if any roads have supplied to sufficient extent. We cannot effect the savings from more economical rolling stock unless we take care of it. We cannot always "take out" on a bank account. We must also "put in."

You know your proportion of bad order cars. I do not. You know whether the number is above or below the average, but it is perfectly safe to say that the proportion may be reduced on every road by additional facilities that will put cars back on the road in a shorter time. It is well to remember the impressive statement on page 30, indicating the loss of 4% bad order cars to be $100,000 per day.

Then comes the question of the men. It is my opinion

that car repair forces are remarkably well organized. The cars and reliability of car inspection forces would surprise the public if the facts were better understood. They know the standards and report most intelligently on what the car needs.

Then comes the repair question. Because quick, thorough repairs saves the building of many new cars, and the same thing is true of locomotives, repair facilities should be most generously supplied out of funds that otherwise must go for new rolling stock. Will you have more cars to increase what is already an overload on shops or will you have more shops and more machinery to get more service out of the money already spent?

As to men, Cardinal Gibbons said in a recent interview: "Expect great things, great things of your fellow man and of yourself For great opportunities are ahead, greater than any that have come before. But only those who have the courage and vision to expect them will profit when they come."

As to supervision, and that is the important factor in car and also in locomotive repairs, let us bear in mind the fact that "the foreman is the top sergeant of industry," and that he must be selected and trained accordingly. Is it not pitiful to see how a great many men when promoted to position of importance get out of touch and out of sympathy with the men in the ranks. Foremen need a helping hand and strong influence over them to provide the efficiency in a large organization that is easy to secure in a small one. Writing on the Nation's Business, James B. Morrow gives an inspiring picture of the Hon. E. E. Clark, Chairman of the Interstate Commerce Commission who was a brakeman, then a conductor, and until recently was the only railroad man on the Commission. He once said to a friend, "If a brakeman walks to a switch to let a train on the siding or walks back so as to flag any train that may be approaching, he is not of much account. If he runs, make him a conductor as soon as you can." Herein is a fundamental idea in the selection of a Foreman.

Let us remember that busy days will come again and that goods will be waiting for cars. Let us get our repair facilities in order. A quick and very easy way to save barrels of money is to bring the shop up to date, up to the efficiency of the best locomotives, the best cars and the best

men, to protect an investment of over three billion dollars in steel cars.

Chairman:

Our time is getting somewhat short but there are two gentlemen that we would like to hear from to-night. One has been associated with Mr. Lynn for a number of years, Mr. Roy V. Wright, who is now Managing Editor of the Railway Age.

Mr. Roy V. Wright:

Mr. Chairman and gentlemen,—

The club is to be congratulated in having this paper by Mr. Lynn. It would be hard to find two men who have had more practical experience with steel cars than Mr. Lynn and Mr. Tatum. When we started to design steel cars, about twenty years ago, we had very light locomotives and we did not know much about stresses met with in train operation; moreover, the cars received more or less careful handling in the yards. If these conditions had continued the cars might have given good service almost indefinitely.

If a better metal is needed the manufacturer will no doubt be able to furnish that metal, provided the railroads are willing to pay for it. It is simply a business proposition.

Mr. Lynn, in a paper before the Railway Club of Pittsburg, stated that the life of the steel car depended upon the right kind of maintenance. It is true, as already stated here to-night, that there are railroads having steel cars but which have no facilities to take care of them. The Pittsburg & Lake Erie is to be complimented in that it was one of the first roads to put in a plant to take care of steel cars. Unless the railroads do quickly provide adequate facilities they are going to have a serious time in the near future.

We have got to lay out a definite programme for maintaining freight cars. How do you shop your locomotives? On the mileage basis. You know that a freight car ought to have an overhauling every seven or ten years, but do they get it? Not on your life! If a steel car requires a thorough overhauling and rebuilding every ten years, then ten per cent of the cars should be regularly shopped for such repairs each year. Until we get down to a scientific programme for repairing our freight car equipment we are certainly not going to keep it in good operating condition.

Chairman:

With reference to copper in steel and the corrosion of cars, there is a very interesting article in the March 5th issue of the "Scientific American." This is of so much interest that I will quote it in its entirety.

COPPER IN STEEL AND THE CORROSION OF CARS.

By A. R. Surface.

There has been for several years considerable controversy as to whether the presence of copper in small quantities in steel plates is a preventive of corrosion. To determine whether results would be obtained in the bodies of steel railroad cars and their life prolonged, the Bessemer and Lake Erie Railroad early in 1914 ordered 100 hoppers and 100 gondola cars used both copper-bearing and plain steel plates in the same car body.

It would be impossible to make a true comparison of the two kinds of steel if placed in different cars, as no two cars are used under exactly the same conditions of service. To make this test truly comparative, these cars were built so that the body of each car was made up of half copper-bearing steel and half plain steel.

These cars went into service in 1914. Considerable throuble has been experienced in locating them for inspection. The first cars inspected after two years' service showed that the paint on the outside of cars adhered much better on the copper-bearing steel than on the plain steel. The fact has been borne out by all subsequent inspections, and at the end of six years is very noticeable, as will be seen by comparison of the illustrations showing the plain steel and the copper-bearing steel plates in the same car. As a result of the absence of the protective coating, the plain steel shows considerably more and deeper pitting on the outside of the cars.

On the inside of the car, the copper-bearing steel was freer from adhering oxide or rust and less deeply pitted than the plain steel.The accumulation of rust under the rivet heads showed that the loss in thickness was considerably greater on the plain steel than on the copper-bearing steel.

On the outside of a car where the paint had come off recently, a pronounced difference was noted in the color of the exposed surface. The plain steed was rough to the hand, yellowish brown in color, while the copper-bearing

steel was much smoother and of a dark reddish-brown color.

The destruction of the body of a steel car is due to several causes, among which are mechanical abrasion or erosion, and corrosion.

The character of the loads carried governs the destruction by mechanical abrasion, as there will not be as much abrasion with materials like ore, earth or cinders as with hard, heavy materials such as pig iron, steel blooms or billets. Mechanical abrasion also has an effect on the corrosion, tending to increase the corrosion by wearing away the corroded surface and exposing a fresh betallic surface, which rusts more rapidly than a surface protected by dirt and a film of oxide or rust. This explains why it was noted in the first inspections that the gondola cars were showing greater effect from erosion and corrosion than the hopper cars.

Mr. W. H. Ludington:

Mr. Chairman and gentlemen,—

The standard repair job of a hopper car consists of replacing part or all of the parts itemized below, depending upon the condition of the car to be repaired.

Removing of side sheet, side stakes, side sheet extension, top sheet angle, outside hopper sheets, doors, sloping floor, longitudinal hoods, cross ridge sheets and inside hopper sheets.

The usual repairs to hopper cars does not include replacing such parts as ends or body bolsters.

Standard repairs consist of dismantling the above parts approximately in the order named, but in this dismantling consists mainly of removing the rivets and thus freeing the sheets from braces.

The standard practive of removing these rivets will vary slightly in different shops, in some cases the heads are removed by a mechanical rivet buster and the rivet is then driven back through the plate, however, the determining factor of the method used is based on cost. However, at least 25% of the rivets to be removed, taking the repairs of a car as a whole, are inaccessible to the mechanical rivet buster, and the oxy-acetylene cutting torch is resorted to on account of its convenience.

The burning of rivets has become so universal that special tips are designed to facilitate this work.

While I have specified the standard hopper car above the practice outlined will comply, with the exception of such parts as the longitudinal cross ridge sheet which is peculiar to the

hopper car, to the following gondola cars, gondola drop bottom, gondola side dump and hoppers combined.

Regarding the cost of burning rivet heads on the three sizes of rivets in general use, namely, 7/8", 3/4", and 5/8" button head rivets. The average operator with the standard equipment will cut from 300 to 350 per hour using from 125 to 150 cu. ft. of oxygen and from 15 to 20 cu. ft. of acetylene per hour. The cost of cutting —the different sizes of rivets varies little, as the greater part of consumption of gas and time required is consumed in preheating, and the time required for preheating the different sizes of rivets is approximately the same.

The information given here on cost will serve for estimating purposes when considering the advisability of removing rivet heads by the oxy-acetylene process against any possible mechanical means. Of course, the cost of cutting rivet heads either mechanically or by the oxy-acetylene process will vary within wide limits depending upon the efficiency of the operator.

Mr. C. E. Chambers (Central Ry., New Jersey) :

As to the subject of patching freight equipment, especially steel gondolas, I am fully in accord. Scattering sheets will deteriorate faster than other sheets by reason of certain commodities which come in contact with them under load, and it is a simple matter to place a rough patch on the inside of the car, held by rivets at approximately one-tenth the cost of renewing the entire sheet. This, as a rule, will continue the card several months, and sometimes two or three years in service when other sheets may become deteriorated to the same extent, and a new side can be applied. This shortens the shop time of the car when repairs are made, and does not materially increase the shop time when the heavier repairs are made.

As to the subject of painting steel car equipment, I am quite insistent. On this road, with which I have been connected for about 19 years, it has been the practive to periodically paint steel cars about every six or seven years. To do this we first sand blast the car, which is not an extensive operation, to clean all the rust and loose paint off the car, after which it is painted by spraying two coats, and then stencilled. This gives the car the best protection, with a minimum amount of money, to my mind, that can be given, and from the fact that the greated depreciation takes place on the inside

of the sheets, the periodical painting will double the life of the car.

On the subject of heavy repairs to steel coal car equipment when it has reached the stage where practically the top must be replaced, to my mind is a thing to be governed entirely by conditions. In my experience I have seen the time when, due to very low market value of new parts, an entire new body could be purchased to place on the trucks, at a lesser cost than Class 1 repairs would be. This, however, is a rare occurrence, and my thought is that so long as the steel frame is sufficiently strong and not deteriorated, that the proper thing to do is to renew whatever parts of the superstructure are necessary, which may be slope sheets and hoppers, or including the side sheets. Where steel cars are to receive extremely heavy repairs, the real up-to-date modern shop is a necessity. Special provision can be made so that an entire side can be bolted up, riveted, and then placed in position on the car. This is a much cheaper operation than assembling piece by piece and riveting in place by hand tools.

The majority of railroads in the States have not, up to the present time, been equipped with proper freight car repair shops, which has not only retarded repairs, but also caused a lot of lost time by reason of the men not being protected against rain and snow.

The more comfortable and attractive repair shops can be made, tthe better class of labor will be secured and not only the efficiency of the men be increased, but loss of time prevented.

Mr. J. B. Starkey (Can. Pac. Ry.):

Electric welding has been used in a large measure to replace rivetting in ship building, and other industries.

According to data which I have, the joint is as strong as a rivetted one, and the time occupied in building ship hull is reduced greatly.

In view of what has been said this evening, in connection with the condition of large numbers of freight cars, and the need for immediate action to put them in serviceable condition, leads me to think that possibly welding could be used to some advantage.

I would like to ask Mr. Lynn if the welded type of construction has ever been tried out in car work, and to what extent, and with what success.

Mr. S. Lynn:

In reply to Mr. J. B. Starkey, of the Canadian Pacific Railway, who raised the question as to whether electric welding has been tried out on car wark, will say that we have not gone into the electric welding of the body of the car itself, that is, the welding of the sheets together. We have experimented to some extent welding castings and other parts for use on freight cars and we have also experimented with electric rivet heaters and torches for removing rivets. We have not, however, gone into the work sufficiently that I could make a statement that would be of any interest on the subject.

Mr. F. S. Gallagher (N. Y. C. R. R.):

It was very interesting to listen to "Dr." Lynn's paper, and Mr. Lynn is in a position to discuss such a paper on account of his being among the first to tackle repairs to steel cars. The discussion following the paper was confined to repairs and maintenance. This was, of course, strictly proper, because Mr. Lynn's paper dealt with repairs or maintenance of steel cars, and the discussion I must say was very ably handled by those participating.

I had the honor recently to address the New York Railway Club on the subject of "Defective Freight Cars and Their Relation to Loss and Damage," and in order to properly bring out the several points of interest incident to the subject, it was necessary for me to touch upon maintenance, a subject which will require a great deal of time and study, especially in connection with steel freight equipment.

Briefly, my thought at that time was that there should be some system or designated method of repairs to freight cars of all classes. We construct the freight car, the most important of all vehicles, in the best possible manner known to the state of the art and then we put it in service, and there it stays until some part of it fails, due to lack of attention. In the case of the locomotive or passenger car it is different. Locomotives are usually given designated repairs after a certain mileage, and the same is true of the passenger car, but usually on a time basis, but the freight car is given no attention whatever except the attention necessary to keep it in running condition and maintain safety appliances. Why should we not treat the freight car in the same manner as we do the passenger car or locomotive, thus always keeping the car in first class condition rather than allowing it to run until some yard inspector happens to notice something is the matter and cards the car to the repair shop.

To successfully work out a scheme of having certain designated repairs made to cars would require, of course, the co-operation of all the railroads in the country, because it would be necessary to have the cars returned home for these periodical repairs, or the railroad in whose possession the cars are at the time, should be required to make the repairs the same as we do with the cleaning and maintenance of air brakes at the present time. I have in mind now cars that are between four and five years old which need attention and are scattered all over the country. These cars should be painted, and if a stencilling on the car would require that between certain periods the cars must be painted in accordance with the owning railroad's standard practice, or return to the home road for painting, it would not work a hardship upon the road operating the car, and the owning road would know that the cars are receiving necessary attention. This same scheme should, in my judgment, be followed for repairs and care of other parts of the car, such as the draft gear, roof of the box car, trucks, etc. Of course, when there is a shortage of equipment it is kept moving as long as it will hold together and it is only sent to the shop when in the judgment of the yard inspector the car is unsafe for operation. This is a condition which should not prevail. I mean by this that the car should not be allowed to remain in service until some part fails, but the failure or wearing out of parts of the car should be anticipated and the car always kept in first class condition.

I have heard the statement made that 19 percent of the loss and damage to freight is due to defective equipment. This may or may not be the exact figure, but we do know that defective equipment does damage and cause loss, and the way to reduce this sort of loss and damage is by having less defective equipment and we could have less defective equipment or so-called "percentage of bad orders" if certain designated and pre-arranged repairs were made to the cars to keep them in first class condition all the time.

It was stated during the discussion that the floor of a hopper car would last from 12 to 14 years. This is evidence that a new floor should be arranged for cars of this class during that time, and the whole car could be dissected so that certain designated repairs could be arranged for.

During the discussion it was stated that the life of a car depended upon certain strengths of the car. This is true to the point of where the vehicle is not maintained to its standard or if there is an error in design the error should be cor-

rected before the failure due to the error causes expensive failure to some other part of the car.

It would be easy to elaborate on this subject of periodical repairs to freight cars, but I think what I have said will bring out the thought that we cannot expect to build the car which will remain in service continually with present day railroading without having to see at certain intervals that everything is in first class condition.

Mr. H. R. Naylor (Can. Pac. Ry.):

The subject under discussion is one of the most important insofar as car maintenance is concerned.

The repairing of steel equipment is a problem which to the majority of railroads is becoming more general, due to the fact that cars built from 10 to 15 years ago, "with the object of eliminating repairs," are to-day badly in need of extensive repairs, and in many instances rebuilding entirely. The design and construction of cars during this period has been undergoing a complete change, and the weakness of the earlier types are becoming more evident furnishing us with repair problems to-day and paving the way for better designs in future.

Insofar as steel car repairs are concerned, we might consider separately the various types of cars. First—the steel centre sill or steel underframe car, secondly—the steel frame car, such as the box car, and finally the all-steel car.

Providing the steel centre sill was designed sufficiently robust, the cars with this construction have well repaid the investment, and reduce more than anything else the repair costs. When applied to refrigerator cars special means should be taken to protect then from brine leakage which sets up rapid corrosion. The floors of the cars should be made water proof, and special attention given to drips to see that overflow is discharged clear of the underframe and trucks.

The steel frame car, of which the most common is single sheathed box car, has proved fairly satisfactory, except in the earlier types on which the end construction was too light, resulting in burst ends, but with the adoption of the steel end this difficulty is being overcome.

The all-steel car, of which the coal car is the most common, provide the repair shops with their biggest problems to-day. The corrosion of the underframe is so rapid that the average life does not approximate that of the wooden car of 15 to 20 years ago, and in many instances tthe incentive for making

repairs is due to the car having been built only a short time, and comparatively speaking, is new equipment.

The repairing or reinforcing of steel equipment, especially coal cars, calls for more systematic handling than wooden equipment. For instance, on wooden cars decking of a standard thickness is adaptable to certain classes of cars, although built at different periods, the slight difference in length being easily taken care of. This is not the case with steel coal cars, the underframe, hopper doors and side sheet construction being different on each series built. This is one of the difficulties in maintaining steel equipment, and to make repairs economically it is advisable to shop a specified number of cars of one series at the same time, which permits of new doors and other parts being made up in advance and in sufficiently large quantities to reduce the cost of production. The advantage to be gained by avoiding too many types or designs is very evident.

Corrosion being the cause of most of the repairs on steel equipment, particularly coal cars, what steps can be taken to prevent, or at least minimize the trouble. It will be noticed that horizontal plates, such as floor or hopper doors, center sill cover plates and similar plates perish far more rapidly than vertical plates, such as hopper side sheets, or the webbs of centre sill channels due to the corroding acids permanently lodging on them. It is, therefore, suggested that such horizontal members as far as possible be avoided, and where necessary reduce as far as possible in area. On some types of coal cars the centre sills could be protected from the corroding acids by a light section cover plate, independent entirely of the sill construction, and which could be quickly renewed. This would overcome much of the sill reinforcing at present necessary. I think it also would be an advantage to anticipate the more rapid corrosion of the floor doors and similar parts and increase the thickness when building new equipment.

Mr. E. R. Viberg (Canadian Car & Foundry Co.):

Mr. Chairman and gentlemen,—

As builders of equipment we are not in a position to extensively discuss repairs and maintenance of freight cars as we have only repaired a small number of cars, and these only in recent years. All told, the Company which I am connected with have repaired 5,500 cars consisting of all steel general service cars and steel coal hopper cars, steel frame box cars, refrigerator cars and all wood box cars. I

have come to the conclusion, by observation during repairs on the above mentioned cars that the best way to determine the proper design is to investigate cars which have been in service and placed on repair tracks. I might state that in no other way can defects in design be determined than to watch cars during repairs as, then only, is the designer made acquainted with the weak points.

On page 25 Mr. Lynn states that freight cars should be designed of sufficient strength to withstand the shocks incident to modern service. From the designer's standpoint this matter is one of the most difficult questions to settle, as the shocks due to starting and stopping of trains and handling in Switch Yards, varies to such a great extent that, in my opinion, it is impossible to construct a Centre Sill having an area which will withstand the enormous buffing shocks set up at certain times, and, consequently, the construction must be made reasonably strong, within commercial limits, to take care of ordinary stresses.

In designing new equipment we are designing Centre Sills for a buffing shock of 300,000 lbs., while the A. R. A. requirements for draft gear capacity is only 150,000. In this connection beg to refer you to the paper read by Prof. Louis Endsley before the Canadian Railway Club on the subject of Draft Gears. Unless we put a draft gear of sufficient capacity in the cars to keep it from going solid the force is going to the weakest part. If this is the coupler, it will be from 400,000 to 700,000 lbs, on most couplers in service or, if the cars be equipped with the new M. C. B. coupler type "D" this force will be from 600,000 to 1,000,000 lbs. Now, if it be the underframe that is the weakest, and this may occur if the design is not correct, this pressure will be a little less than that given above for the coupler. In any case, this force may be 600,000 lbs. If the Centre Sills are properly designed the above mentioned force, together with stresses due to loads, can be taken care of and still keep within reasonable area, preventing Centre Sills from failing in service. In order to obtain these results, material must be utilized and light weight searificed to a certain extent. It would be interesting to ascertain what Mr. Lynn considers sufficient for Centre Sill area to properly sustain load and keep sills from buckling and also the maximum shocks that cars receive in service.

Personally, I feel that centre sills and draft arms should be designed strong enough to stand the shocks sufficient to

break the coupler. It is easier to replace a coupler than to repair centre sills.

The last paragraph of page 25 Mr. Lynn refers to various reinforcements. I would like to ascertain Mr. Lynn's views on this subject. Does he consider the present method of reinforcering old wooden cars with steel draft arms sufficient? This, undoubtedly, reinforces the car from Bolster to buffer block but still leaves a weak link, namely; between bolsters, in other words, car is no stronger between centre of bolster than before being reinforced. It has, therefore, occured to the writer that a simple steel underframe design, having continuous steel centre sills would be more satisfactory and not any more expensive.

On page 26 Mr. Lynn speaks of painting. This is a matter which should be given serious consideration but, is it possible to obtain a paint that will prevent the cars from corroding. Mr Lynn believes that the exterior of cars should be well painted. Is it not a fact that the corrosion takes place between the steel and the paint, and, in order to preserve the steel as much as possible, is it not necessary when repainting cars to remove the old paint, together with corrosion, before repainting?

In conclusion we all know it is impossible to build a car that will last indefinitely. The designer endeavours to proportion a car to the best of his ability but sooner or later the cars will land on the Repair Tracks due to the numerous causes incident to the service in which they are in.

One thing that should always be remembered is, to keep the stresses and designs within permissable limits. I had occasion lately to analize the design covering cars built in the United States, on which cars the combined forces, produced by stress, was 36,000 lbs., per square inch in the compression member which, of course, is entirely too high and can result, only, in the cars failing sooner or later.

For repairing steel equipment economically it is necessary, in my opinion, that Shops should be equipped as completely as when the cars are originally built. We have found by proper organization and necessary tools that steel freight cars can be economically repaired, and put in as good a condition as when new, at from 1/3 to 1/2 the cost of a new car, at present prices.

All the work must be systematically arranged so as to obtain a continuous operation from the dismantling to the completely repaired car, and, as a matter of fact, arranged

in the same manner as would be the practice in building in cars. Namely: the use of what is known as the track system and, it is only necessary, in my opinion, that the work of fabricating the parts, re-assembling and rivetting, etc., be done inside. The dismantling can well be taken care of outside where plenty of room is available for the discarded parts.

Mr. S. Lynn:—

In reply to Mr. E. R. Viberg, with reference to statement in my paper that cars should be designed of sufficient strength to withstand the shocks incident to modern service. While I concur with Mr. Viberg in that this is one of the most difficult questions to settle, what I tried to bring out clearly was that in the construction of the cars, the designers, or railroad mechanical men, should by consultation with their shop organizations get the benefit or their experience when placing orders for new cars, in order to bring out the weak parts which have developed on existing cars, so that subsequent orders for cars may be designed with a view of overcoming some of the weaknesses which have developed and which are known to exist on the cars already in service.

Referring to Mr. Viberg's reference to the re-inforcement of old wooden cars with steel draft arms, I would like to state here that I was not discussing any betterments to existing wooden equipment. I do not believe that the methods referred to by Mr. Viberg are of any material benefit to the wooden car when that car is used in a territory where heavy tonnage originates and for that reason, I have already stated in my paper that older cars should either be substantially re-inforced or kept on the line of the owning road where they would not be subject to the severe service, as they would in certain sections of the country. There is no question but what the metal draft arm in cars with the old wooden draft timber, re-inforces the car from the coupler to the body bolsters, but as there is no additional strength added between the bolster, the center of the car has nothing to support it, as the wooden sills, which in some cases are badly decayed, permit the car to sag in the center and it is obvious that the application of metal draft sills on a car in this condition, will not affect the cure desired.

Referring to his statement on the painting of steel cars that corrosion takes effect between the steel and the paint

and in order to preserve the steel as much as possible, it is necessary when repairing cars to remove the old paint together with corrosion. This, in my opinion, is absolutely correct and the old paint and the rust and corrosion should be removed. It has been our practice to do this by the use of wire brushes, scraping, etc., when the car is placed in the paint yard before it is coated.

I believe I have covered the points raised by Mr. Viberg.

Mr. J. A. Shaw (Can. Pac. Ry.):

The question may be raised in connection with this paper as to the scope of electric welding in such work. The American Car & Foundry Co., in 1911, built a 50-ton gondola car, the superstructure of which was electrically welded. A special spot welder of 85 K.V.A., capacity was designed and built for this purpose, having a 66'' gap. Pressure was applied by means of a hand wheel, the transformer was provided with various coil combinations to obtain different voltages, and for further regulation a choke coil was used.

It had been decided to spot-weld as much of the freight car as practical ,and, accordingly, the entire superstructure was welded in this manner, except the iron ladder and other small parts. The bottom cover plates of the cross bearers and the entire cover plates on top of the members were spot welded. A few rivets were used to hold the hinge castings in place. The bottom cover plates of the body bolster which carries the entire weight of the load of the car at each end was spot-welded. A few rivets were used to hold the hinge castings in place. The bottom cover plate of the body bolster which carries the entire weight of the load of the car at each end was spot-welded to the flanges of the diaphragm. Three rivets were used to hold in place the cast iron side bearings.

After the car was finished in 1911, it was tested and several test trips were made. It was observed that this car unlike a riveted car would, when a test load is applied, invariably settles, until the rivets obtain a solid bearing. This was not the case in the welded car which was perfectly stiff. The usual deflection was noticed upon loading, but upon removing the test load, the car assumed its original position. After being tested the car was turned over to the Burlington Road, by whom it was used exclusively for the coal trade. In 1916, after the car had been in actual service for five years, it was sideswiped in a wreck. An

obstruction passed between the top end of the strakes and the chord angle which bent these members. All but one spot weld remained intact.

The car has been examined from time to time since it was built, and the welded joints have stood the severe strains of continuous hard use. The car is still in service and is giving as good results as a rivetted car.

It is doubtful if there is any immediate likelihood of such construction being extended due to higher cost. Unless plates are all true without any buckling, a comparatively large number of holding bolts would be required, otherwise, the metal at spot-weld would yield when pressure was relieved, unless the latter was maintained until cooling occurred.

The use of the ordinary metal electrode welding process in steel car repairs is limited and has the objection of intense light from arc, preventing other work being carried on in the immediate neighbourhood.

Electrical equipment, such as rivet heaters, are of material value however, in steel car repair work, due to their greater economy for the heating of an intermittent supply of rivets, and their greater portability. Electrically operated reaming tools are also fast displacing air tools, due to their greater economy in power and labour.

Mr. S. Lynn:—

Mr. J. A. Shaw of the Canadian Pacific Railway, raised the question as to the scope of electric welding. I have already stated that I have not had every much experience on the electric welding of freight car bodies. The only welding that has been practiced in our shop is different parts or castings, which are to be applied to the bodies. I am therefore unable to answer Mr. Shaw regarding his questions as to the scope of electric welding on freight cars.

Mr. J. C. Fritts, D. L. & W. Ry.:

I have read through Mr. Lynn's paper very carefully, and will make a few comments on the same. I have the greatest respect for Mr. Lynn's opinion in regard to car matters, and believe he should be highly complimented for the able manner in which he had handled the subject assigned; viz—Repairs and Maintenance of Steel Cars.

It is true that the majority of freight cars in service at the present time are, in part, of steel construction, and I believe that in the near future, all cars will have at least

center sills of steel. Adequate facilities should be installed to meet this change in Freight Car Construction that is becoming more apparent every day. Some of the larger railroads that first adopted steel in car work and who own a large number of cars of this type, are properly equipped to handle the work, but many of the smaller roads that have in recent years adopted steel, and with only a comparative small number in service, are more or less in doubt as to just what facilities should be arranged for, and I believe that if something definite could be worked out and established as to what requirements or facilities are necessary under varied conditions, it would be a great help for many of the smaller Railroads in deciding this question. It is information that is being sught from many sources at the present time.

In rebuilding of steel equipment, particularly steel coal hopper cars, several questions must be considered.

First: The Original Construction. If the under-frame is sufficiently strong that would warrant the application of a new super-structure, if not, then the cars should be turned into salvage. I find this the case in a great many of the older type of steel equipment.

It would be absolutely a losing proposition if an attempt was made to maintain it in service by either repairing in kind or reinforcing.

Second: The cost of the repairs.

Third: The probable life of the car after repairs or reinforcements have been made.

Fourth: The kind of service that will be required of the car.

These are questions that must be taken into consideration before it can be definitely decided as to what action should be taken.

The Painting of steel cars has been sadly neglected in the past few years, which hurries deterioation and shortens the life of the car. While it is true that on Coal Hopper Cars only one side of the sheet can be painted, but there are many other parts of the car that can be protected and its life prolonged if properly protected from the effect of varied weather conditions.

I noticed only a few days since, several cars where the super-structure such as side supports, and braces, were very badly corroded, and were deterioating at a rapid rate which could have been prevented by being kept covered with a

proper kind of paint. My experience indicates to me that steel equipment of this type should be taken in at least once every four or five years, cleaned and painted. If the framing of the car is protected in this manner even though the sheets corrode, they can be replaced with a minimum cost. Personally, I believe and would advocate the periodical painting of all steel cars, and believe that in the end it would result in a paying proposition.

There are perhaps, many other points in Mr. Lynn's paper which I could mention, but I realize there will be considerable discussion, and do not want to occupy too much of your Club's time.

Mr. J. R. Ayers., (Can. Pac. Ry.) :—

I have listened with interest to Mr. Lynn's paper and to the discussion which followed, from which we have learned a great deal regarding the construction and maintenance of steel freight cars.

On page 26 of Mr. Lynn's paper it is mentioned that the matter of painting steel cars had also suffered neglect and that close inspection of almost any classification yard will reveal this glaring fact. I believe that every member at this meeting who has had practical experience with steel equipment will agree with me when I say that regardless of the type, or efficiency of construction, the steel must be thoroughly protected by proper paint, and a sufficient number of coats, otherwise "corrosion" the arch enemy of the steel car will soon follow and expensive maintenance and a much shorter life of the car will result.

It is my observation that much attention should be given by the Mechanical Department when designing steel equipment to see that pockets where moisture can collect and remain without drainage should be avoided as far as possible, this having been done more care should be taken during construction to see that all laps, joints, and other parts where metal comes to metal are all properly painted with an honest rust preventive paint coating before assembly, also all parts inaccessible after assembly should receive the same attention as to a protective coating before being rivetted together. After construction the whole structure should be thoroughly protected with a sufficient number of elastic paint coats of a type and nature that have proven proper for this type of work.

I believe if the above practice was rigidly carried out

during construction and a policy of painting steel equipment every two years maximum adopted, much longer life, much less replacements and consequently less maintenance cost will surely follow.

Also on page 26 of Mr. Lynn's paper it is shown that it is practically impossible to keep paint on the inside of open top steel cars due to the damage caused to the paint by loading and unloading and that moisture laden with acids from products of mine and mill cause very rapid corrosion of the metal, I have learned that certain coal carrying roads have been experimenting with the interior of open top coal cars by coating the entire interior occasionally with a liberal application of a heavy non drying oil which finds its way into all scale and other rusted parts, the idea being that this would neutralize the acids, and at the same time protect the metal from moisture. I am not certain whether this oil is of mineral, vegetable, or animal nature, but I would be glad to learn what results have been obtained from these experiments as I believe there is much merit in such treatment.

Mr. S. Lynn:—

Mr. J. R. Ayers of the Canadian Pacific Railway raises the question as to the painting of steel cars. Would say that it is our practice on heavy repair work to see that all laps, joints and other points where the metals lap, are given a heavy coat of paint before the parts are assembled. This is done with a view of having the metal protected where it laps, or where is a possibility of moisture getting in and starting corrosion of the steel.

With reference to a non-drying oil coating on open top coal carrying cars, I do not know that this method is being followed by any railroads. Some few years ago a committee of the M. C. B. Association went into the matter with a view of developing a protection for both the inside and outside of the metal on steel freight cars and a report of this committee will be found in the proceedings of the 1909 convention.

I have not been able to find any report after 1909 showing the conclusion of the committee investigation, however, their report for 1909 stated that in order to obtain good results, cars should be oiled every six months and in my opinion this would be impracticable.

Mr. W. H. Hickok, (D. & H. Ry.):—

Mr. Chairman and gentlemen. The Company I am con-

nected with own several thousand coal cars of the composite type. These cars have been in service about 15 years and are in good condition and we find it is cheaper to maintain this type of equipment than the all steel.

I am not a believer in the all steel coal car. Mr. Lynn speaks about reinforcement.

On one type of car we have applied a reinforcement to the center sills or channels by running a flanger piece through the body bolster, extending beyond both sides of center of bolster and riveting it to the outside of the channel. We have also applied an additional top cover plate extending 30″ each side of the body bolster.

This reinforcement has given very good results.

Mr. S. Lynn:—

Messrs. Gallagher, Naylor, MacEnulty and Hickok practically concur in my views.

Mr. J. F. MacEnulty, (Pressed Steel Car Co.):—

I have, Mr. Chairman and gentlemen, read with much interest Mr. Lynn's paper. Mr. Lynn os evidently well informed on the subject of maintenance of modern cars, which means steel cars.

One fact that strikes me, in reading this paper and also in talking with mechanical people on various railroads, is that many of the railroads, in the United States at least, do not have enough of the shop equipment which Mr. Lynn rightfully says is necessary for the heavy work required in rebuilding old cars and to properly take care of and keep in good condition the steel cars which have running for a number of years and which during the war, for many causes, were not repaired to the extent they should have been. The situation today is that to purchase this shop equipment and to arrange for the proper shop facilities, etc., means an enormous expenditure of money. This money under present conditions is difficult to secure, particularly when everything is needed,—new locomotives, new cars, improvements to terminals, new tracks, etc., etc. I am not familiar with the situation in Canada as compared with that in the United States. You perhaps have not had the same let down in labor nor have you been beset with the same difficulties under Government operation as we on the other side of the border have. Had I been able to get to this meeting I had intended to say that improvements on the

various railroads, such as building new shops for repairs to cars, had better be left until the last, and the money that could be obtained be utilized for new equipment, improvements to terminals, etc., instead of spending it for repair shops of which there already exist many which can do the same work, and under present labor conditions, much more advantageously and at no greater cost.

There are a number of industrial companies who have been making heavy repairs for various railroads for many years and also new companies have started up since the war who are also efficiently equipped. The experience of railroads in the United States having cars repaired in outside shops is, that even with a higher overhead applied on direct labor than the railroads themselves, figure, and with profit added, it is more economical to have cars repaired in contract shops than it is for the railroads to attempt to do it themselves. This may sound like an extravagant statement but as a matter of fact we have had experience recently in rebuilding cars for some railroads in the United States and the railroads at the same time had cars of a like series for same general repairs in their own shops, but working day work as in necessary under agreements now in force, instead of piece work. These railroads found that cars turned out of contract shops—one of which was ours—cost less than the cars repaired by the Railroad Company and were also put into service at a much faster rate. This latter fact, however, without any freight to haul, is at the present time not much of an advantage to either party as it only increased the obligations of the railroads when they had no money. At the same time the fact remains that contract shops working piece work can do better, quicker and cheaper work than the railroads themselves working day work.

Many of the contract shops have disregarded the old method of repairing cars on rip track, that is tearing down the cars, carting away the debris and then bringing the new material to the repair car and building them up in their original position. It has been found to be more advantageous to run the cars through in a yard laid out for this kind of work on a track system, which means that the parts torn down can be taken away at any time desired and the car itself moved to the new position where new material is already laid out. This can be done better, of course, on cars which require repairs to the one class, and in the United States there are many such cars.

These remarks are not intended particularly as an advertisement of the Company that I happen to represent but is the feeling of many of our railroad executives in the United States that expenditures at the present time should go for new terminals, new tracks, new locomotives and new cars and that where the equipment needs rebuilding or heavy repairs that instead of expending money for new shops at this time it is more economical to let contracts to industrial companies that can do this work, leaving the new shop equipment for car repairs for some future date when the earnings warrant it.

Chairman:

The time is so late that I cannot call on anyone else but I would ask that if anyone came here prepared to speak, if he will kindly mail his remarks to the Secretary they will be included in the minutes when printed. Mr. Lynn, is there anything further you would like to say?

Mr. S. Lynn: —

No, nothing except that I would like to thank the Canadian Railway Club and your officers for the courteous treatment extended to me this evening, and I want to say that it has been a great pleasure to be with you and I hope that at some future time I may come again and sit back with the boys and listen to the speaker instead of taking part.

I would also extend a very hearty invitation to any of the members to visit our club at Pittsburg which meets on the fourth Thursday of each month.

I thank you.

Mr. J. Coleman:

Mr. Chairman and gentlemen,—

The evening is getting late, but I would like to express to our friends from across the line, our appreciation of their visit, and we extend to them the hearty co-operation of every railroad man in Canada. I believe that every railroad in Canada is represented at this meeting tonight, and I am sure you will go home feeling that there is no bad taste or bitter feeling between the railroad men of this country, and I am sure also that our President will be glad to have you return here at some future time. Besides, there are some privileges in Canada that you cannot get at home (laughter), but I am sure that the

railway men belonging to this club do not abuse the privilege, and I am equally sure that you have not abused it. I have great pleasure in moving a hearty vote of thanks to Mr. Lynn.

Mr. G. E. Smart:
Mr. Chairman and gentlemen,—

I am very pleased to second same and wish to couple with it a hearty vote of thanks to our Railway friends from across the Line, and hope they will come back and visit the Club often.

Chairman,

Gentleman, you have heard the motion. What is your pleasure?

Carried.—Great applause.

Chairman,

The paper at our next meeting will be given by Mr. A. Hatton, Gen. Supt. Transportation, Can. Pac. Ry., on "Some Sidelights .n Railway Timetables". Perhaps some of you do not know that a timetable is prepared in a more or less graphical form. Mr. Hatton will illustrate this for one or two working districts so you may see how it is done.

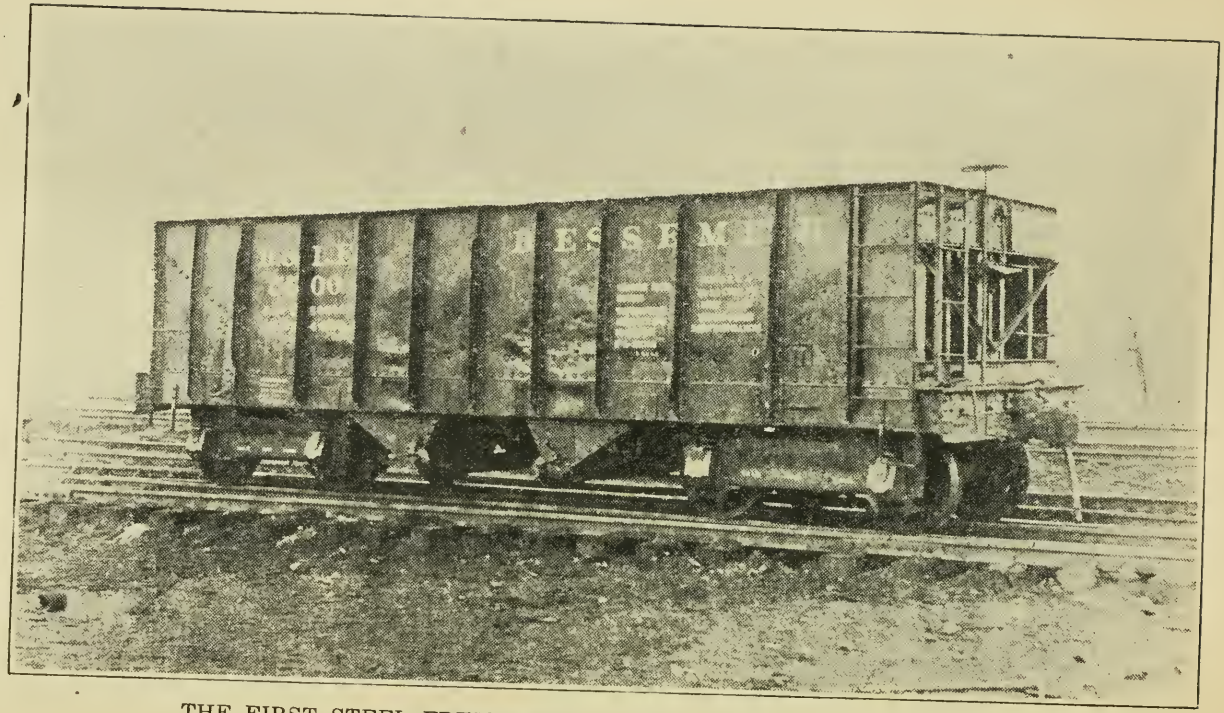
I would call attention to the coffee and sandwiches on the table at the rear of the room. We would like the members and friends stay and partake of them. A motion to adjourn will now be in order.

Mr. F. J. Fradd:—

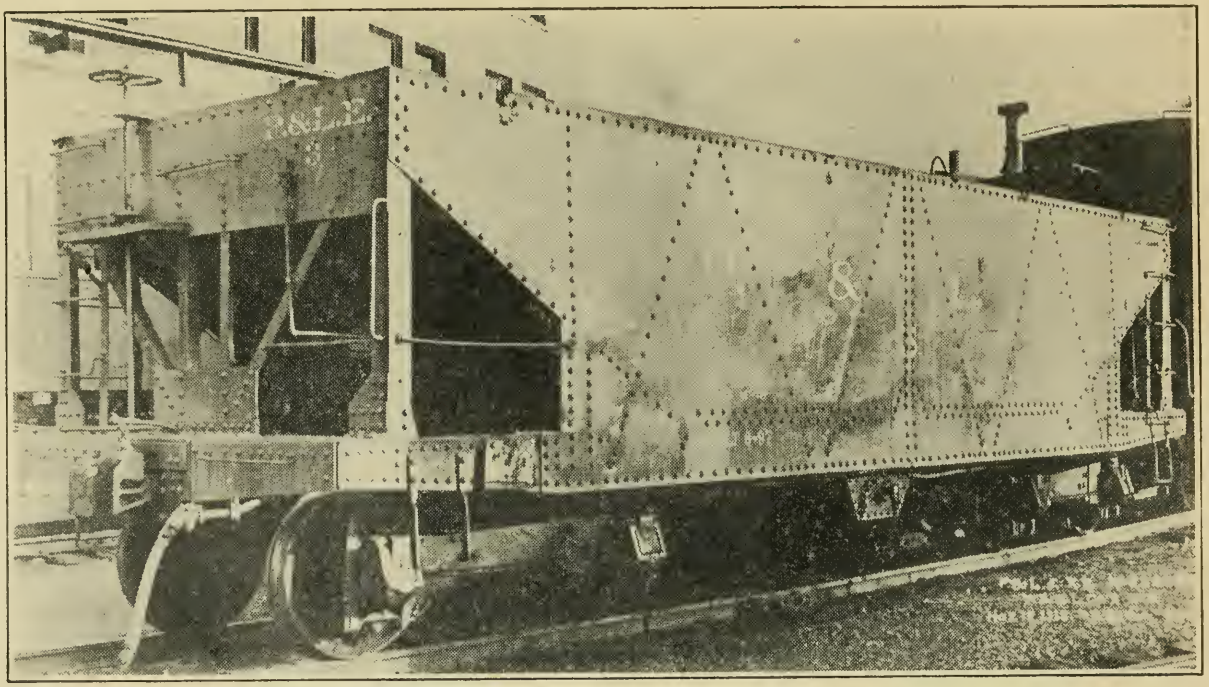
I move we adjourn.

Mr. M. T. Coleman:—

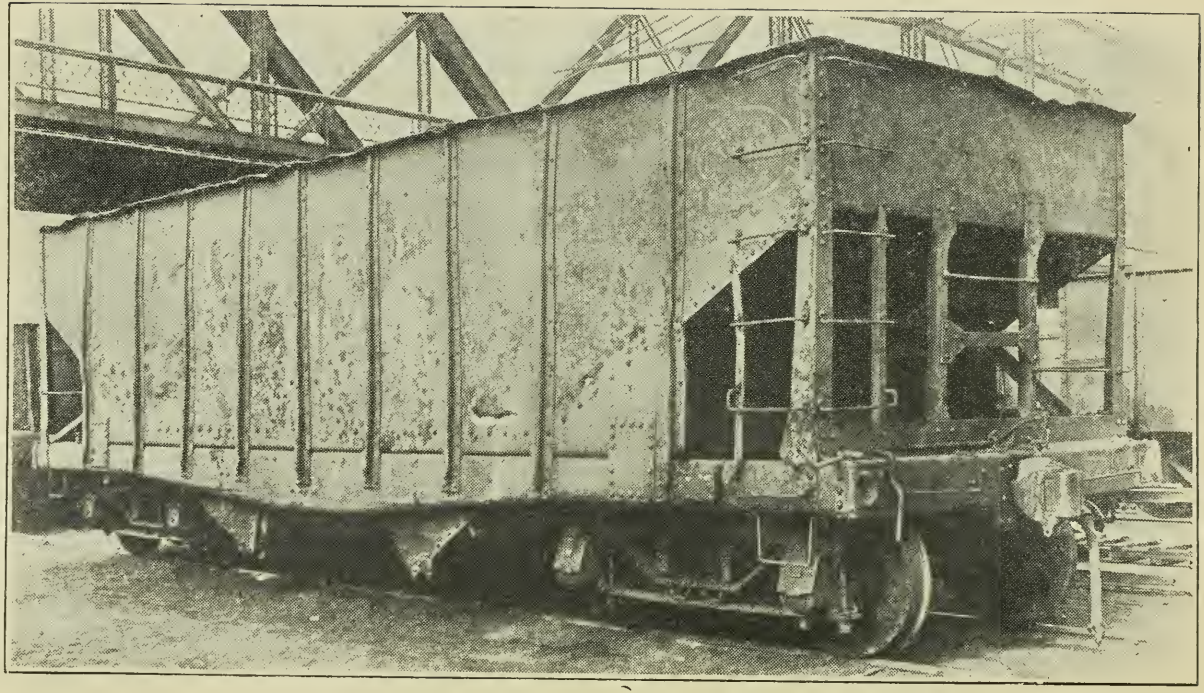
Seconded.



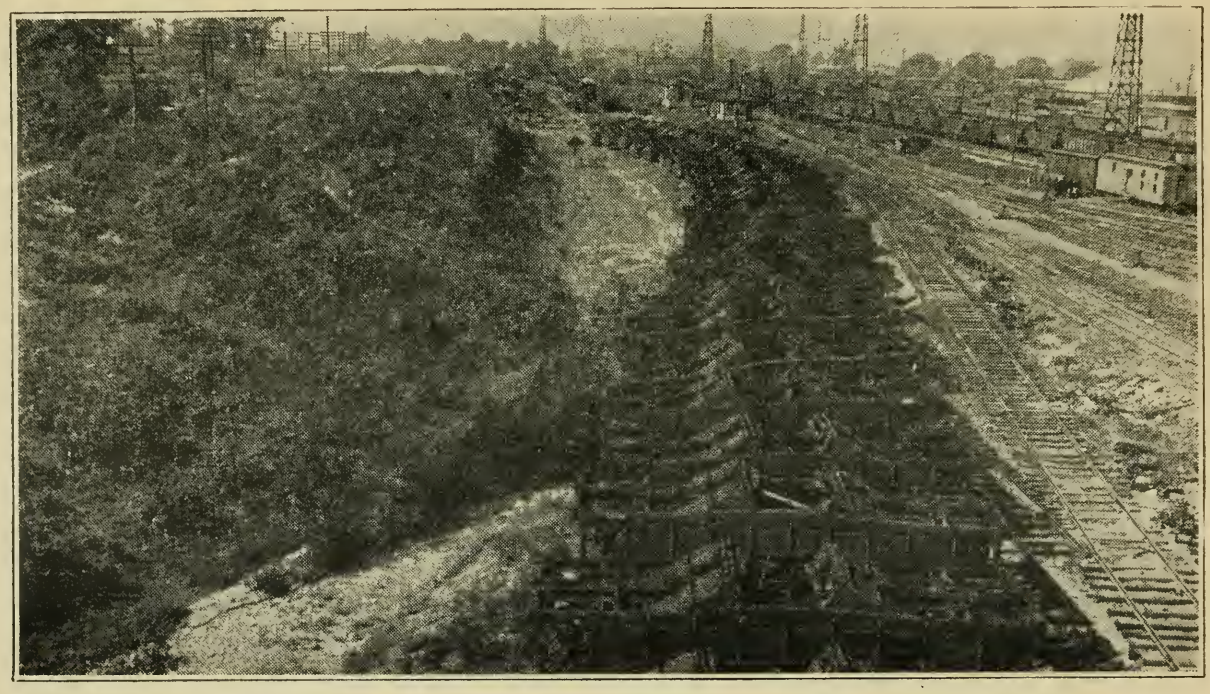
THE FIRST STEEL FREIGHT CAR, BUILT FOR B. & L. E. R. R., 1896.



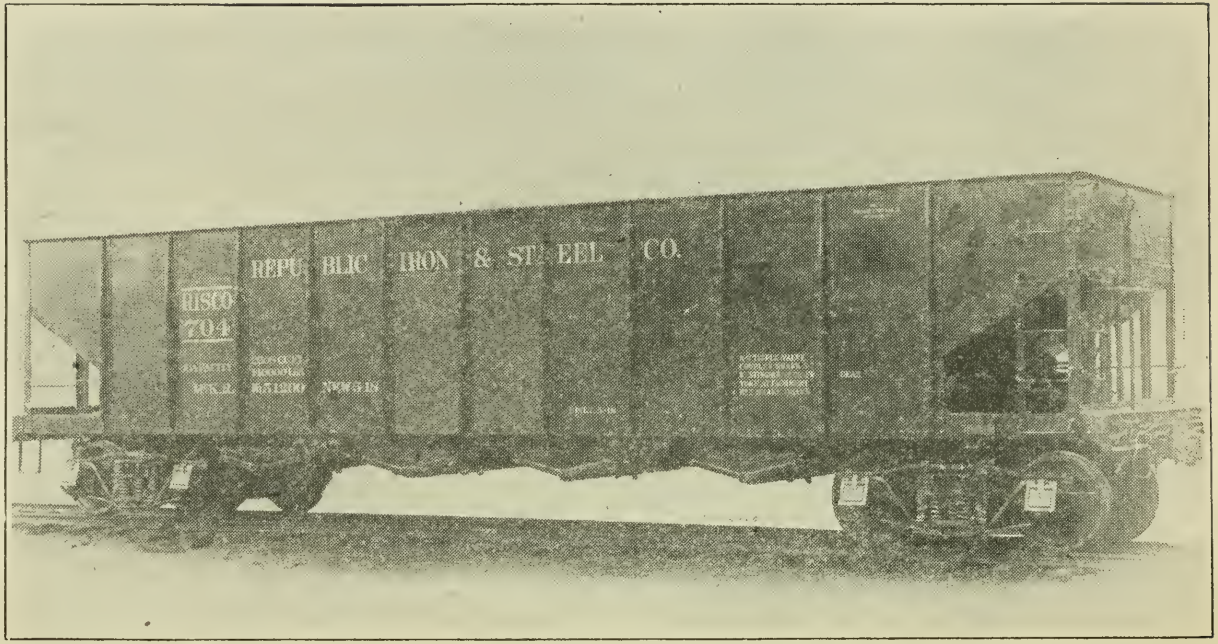
AN EARLY TYPE OF STEEL FREIGHT CAR, BUILT FOR P. & L. E. R. R., 1897.



A STEEL CAR AWAITING REPAIRS.



STORAGE OF STEEL CARS TO BE DISMOUNTED.



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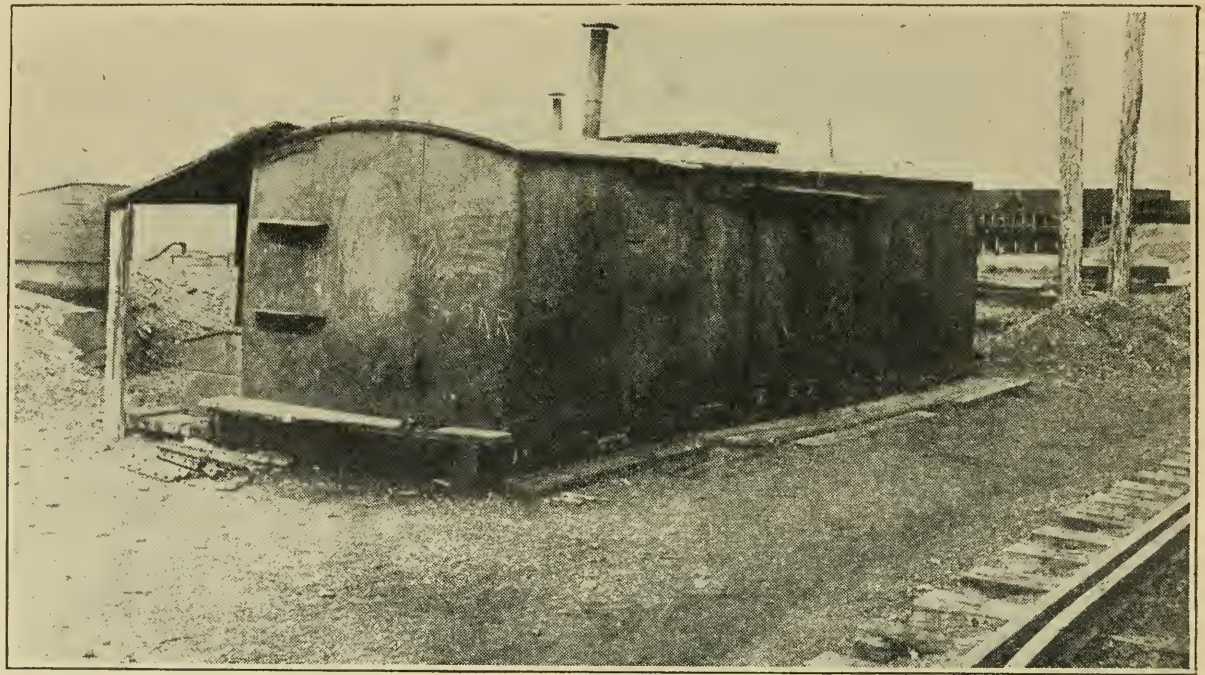

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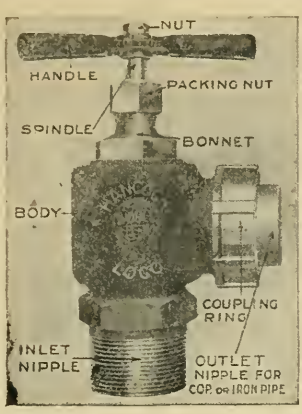

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3	3661	1½"	1⅜"	1½"	1½"
4	3661	2"	1 11/16"	1½"	1¾"
5	3661	2"	1¾"	2"	2"
6	3661	2½"	2-1/16"	2"	2¼"
7	3661	3"	2⅝"	2½"	2¾"

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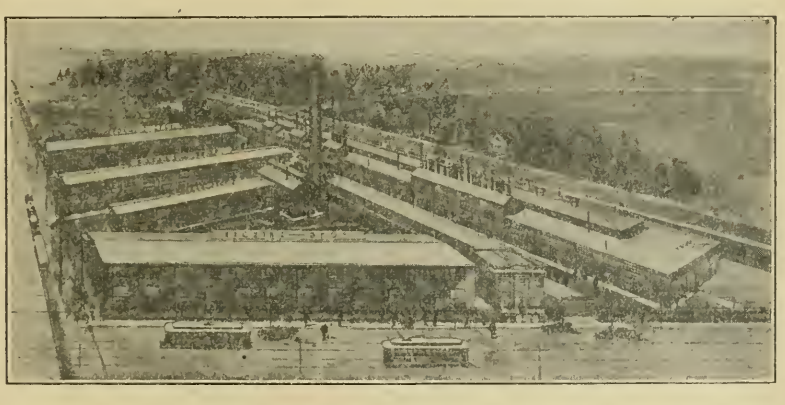

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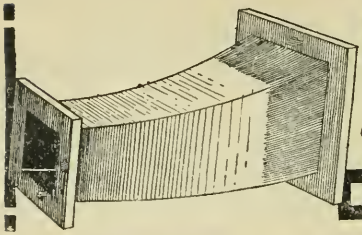

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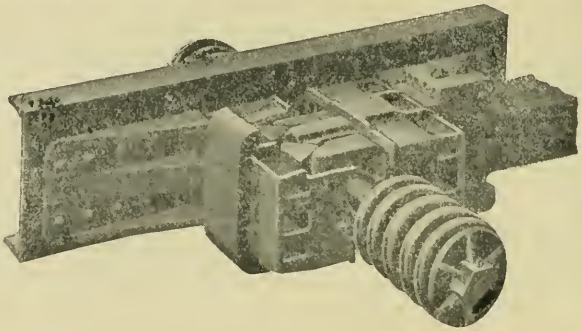

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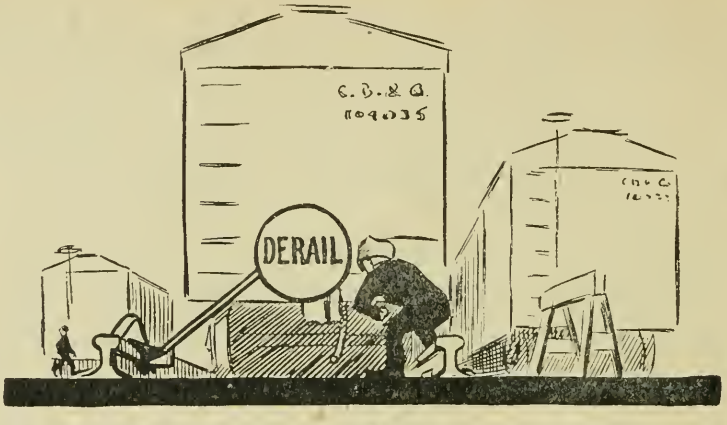

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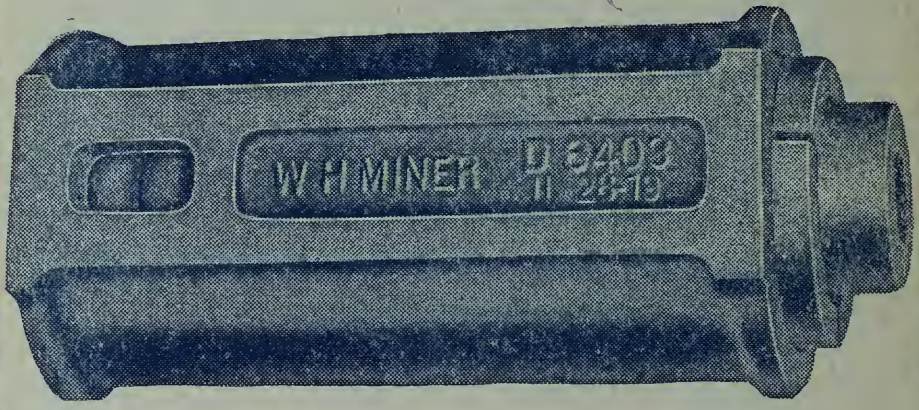

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